computing today

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SEPT 1979
50p

A RACY PROGRAM TO RUN

Speech Recognition

Big Basic For Triton

MPU Swansong

Show Reports

computing today

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SEPT. 1979

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BLASTA PROM

Enjoy wiping out your PROMS? Well you can now erase up to 104 EPROMS simultaneously with a new unit from Microsystem Services. Complete with a built in timer unit and indicators it will either accept whole boards or individual EPROMS. The UV tubes have a life of 2000 hours and thereafter they start to lose efficiency but can still be used. More details from Microsystem Services at Duke Street, High Wycombe, Bucks. Tel. 0494-41661.

HARDING HELP

An urgent release has come our way from A.J.Harding (Molimerx) the TRS-80 Software house. Apparently the CTR-80 recorder can cause severe problems with your tapes, rendering them unuseable. The cure appears to be to put a 1A 50V diode across the brown motor wire, plus to plus-minus to minus. Harding's will undertake to repair any scrampled tapes that they have supplied, for a limited period, but you must include postage to cover costs. A.J.Harding live at 28 Collington Avenue, Bexhill on Sea, East Sussex.

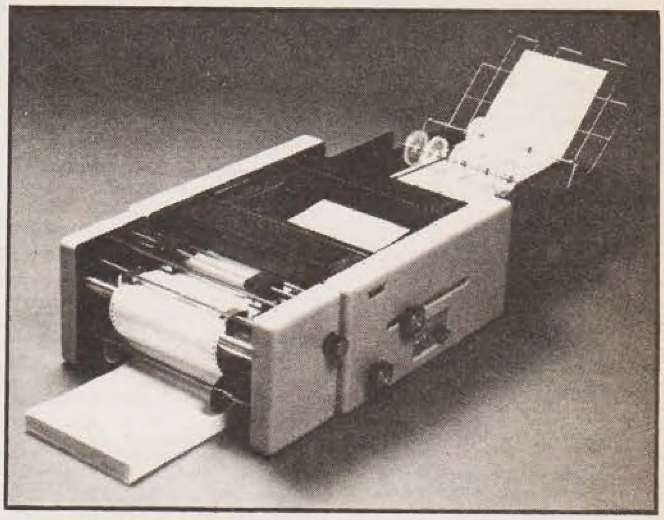
FLOPPY CONTROL FROM INTEL

A new single board Universal Floppy Disk Controller, the iSBC-204 has been launched by Intel. As standard it can control two drive surfaces but can be expanded to four. Using DMA and programmable track access it can read, write, verify and search with most single density soft secored standard or mini drive units.

Also announced recently is a reference card for owners of iSBC 80/20 single board computers, with a wide variety of useful information. For more details on both products contact Intel at 4 Between Towns Road, Cowley, Oxford OX4 3NB.

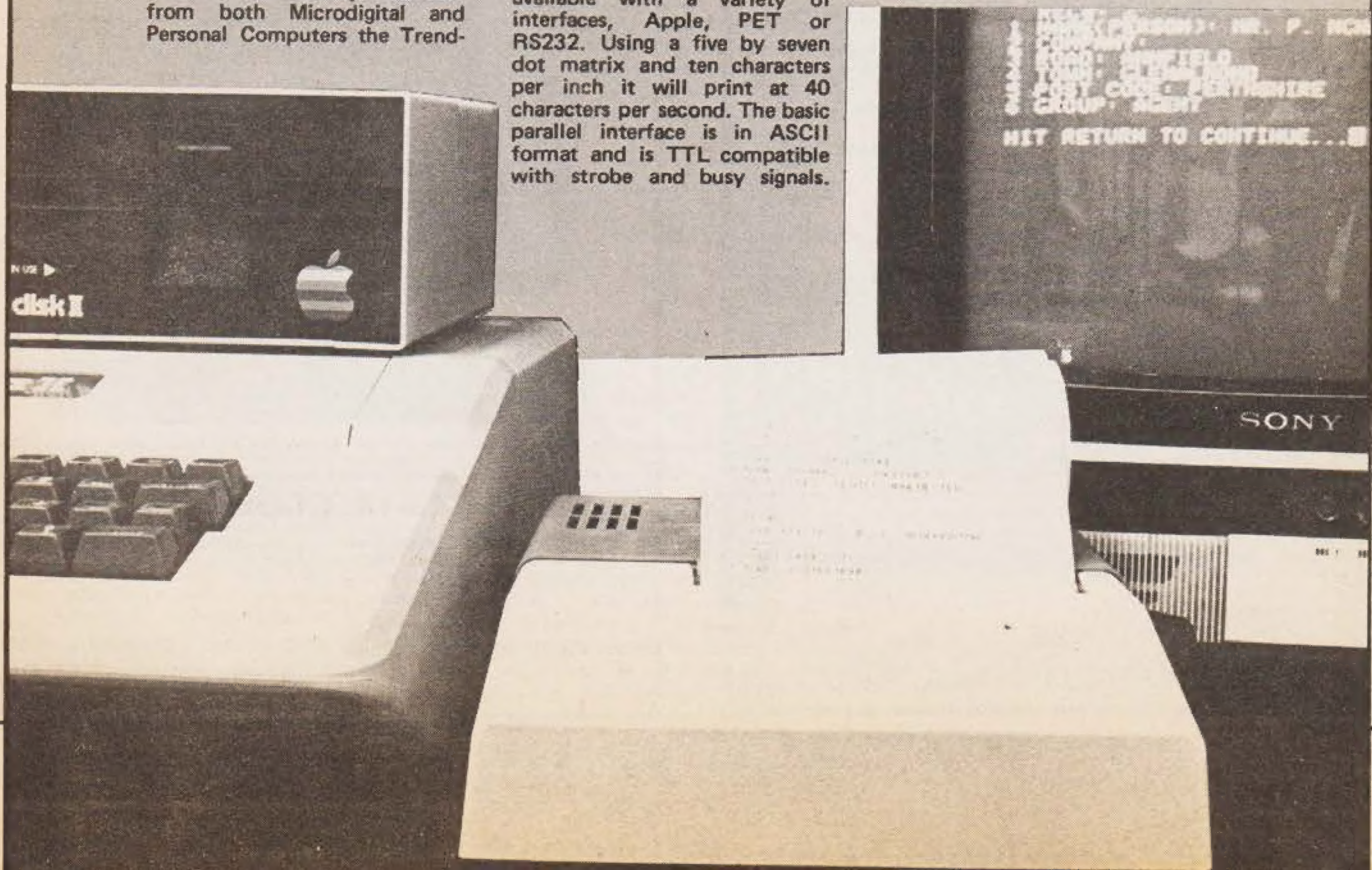
BURSTING OUT

Small business systems are the ideal companion for Cave Tab's Model 2444 table top burster. It can cope with most types of paper stock, cards and cheques at up to 200 feet per minute. The unit can also handle multipart forms and both static eliminator and slitter are available as add-on's. Total price is around £1,150. Cave Tab are at Teuter Road, Moulton Park, Northampton NN3 1PZ, Telephone 0604-48125.



PRINT IT BOTH WAYS

A bi-directional 40 column printer is beginning to make its mark in this country. Available from both Microdigital and Personal Computers the Trendcom 100 is a low cost roll printer. Complete with its own micro the unit uses either black or blue thermal paper and is available with a variety of interfaces, Apple, PET or RS232. Using a five by seven dot matrix and ten characters per inch it will print at 40 characters per second. The basic parallel interface is in ASCII format and is TTL compatible with strobe and busy signals. Supplied complete with integral power supply it will cost around £243 and Apple or PET interfaces are about £43.



CLUB FORUM

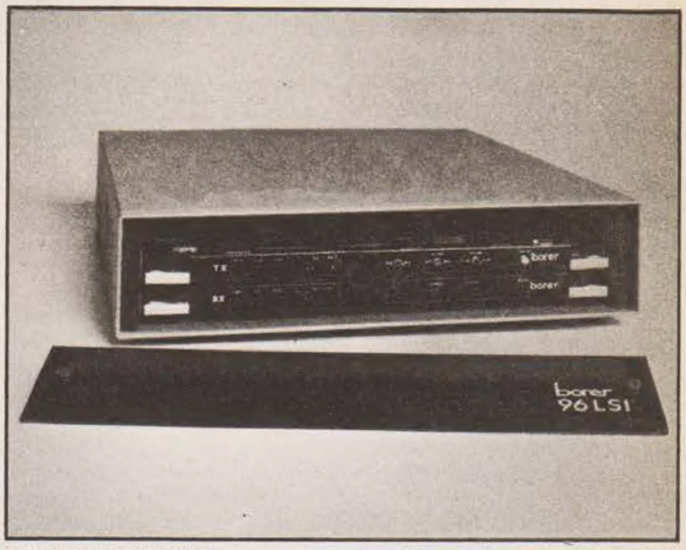
Several more connections to our Club Survey have appeared in the mailbag over the last month. The Southampton Amateur Computer Club (SACC) is based at Southampton University. The correct address is The Secretary SACC, c/o P.G.Dorey, Department of Physiology, University of Southampton, Southampton SO9 3TU. The President, Paul Maddison, can be contacted on Winchester 4433 ex 6955. UK Membership is £3 or £2 for students and OAP's and this includes subscription to Benchmark, the club magazine. The club is also linked to the Southampton University Amateur Computer Club. Club meetings are held on the first Wednesday of the month at 7.30pm, starting in October, and are held at Seminar Room 2, Medical Sciences Building, Bassett Crescent East, Southampton.

The Thames Valley ACC has also requested an update on their club. The primary contacts are now Brian Quarm, Hon Sec, on Camberley 22186 or Brian Steer, Meeting Organiser, on Slough 20034. Mr Chris Wallwork is the Publicity Secretary and may be contacted at Oak Cottage, Ecchinswell, Nr. Newbury, Berkshire. Membership fees have not yet been set but last year was £1 + 50p per meeting. Meetings are held on the first Thursday of each month and they have visiting speakers, outside visits and also cater for special interest groups. As a footnote they are holding a Junk sale on the first Thursday in September with bring and buy stalls, contact them for the venue.

Next on the list is the Oxfordshire Microcomputer Club, formerly the Oxford and District AMC. The primary contact here is Stephen Bird, 139 The Moors, Kidlington, Oxford OX5 2AF, telephone 08675-6703 after 6pm except Wednesdays. They have a membership of 20 and for the Kidlington and Witney areas the meet is on Wednesday nights at 7.30. Membership fees are £5 for April '79 to March '80. A monthly newsletter is published, mainly software. The club also incorporates the Oxfordshire ACC and the Oxfordshire TRS-80 and Z80 user groups. Other meeting points are St. Johns College Oxford, c/o St. Johns Micro Society on alternate Thursdays and for Oxford Polytechnic students contact Paul Duffey at the college for Tuesday meetings during term time.

Finally, believe it or not, I have received a letter from the Burlington-Dnes School Computer Club. They would like to start a magazine for schools computing in the London area, especially for those that have a 380Z Research Machines or use the ILEA RSTS system. Anyone wishing to help should get in touch with the club at the school, Danes Building, Du Cane Road, Hammersmith W12 UTY. Any charge for the magazine will be to cover the cost of production.

Owing to the reader survey in this issue which we hope will bring in some more news of clubs we are holding back the next survey until the Winter. So if you want to be included let me know, address your mail to Club Forum, Computing Today, 145 Charing Cross Road, London WC2H 0EE.



FAST MODEM

Borer Electronics have added a 9600 Band Modem to their range. Called the 96 LSI it provides a 4800 Band fall-back speed for poor quality lines. Using custom MOS/LS1 circuitry and bit slice techniques it provides an economical full duplex system. An advanced multiplexer can be incorporated to give four full duplex controls per channel allowing dial up access or half duplex links. For more info contact Borer at Fishponds Close, Wokingham, Berkshire RG11 2QL or ring Wokingham 783372.

TECS GET POST OFFICE APPROVAL

Remember the home computer system that we reviewed in our May edition which could handle Teletext? Well we mentioned at the time that the firm who were making it were seeking PO approval to use the system on Prestel, the TV/Telephone informatics service. The PO have now given type approval to the system and Technalogics will be able to supply systems from the beginning of September. The system will be using aerial input to your TV so no modifications are needed. They will also be able to convert any previously supplied TECS system to Prestel subject to test. Prices range from the basic kit at £360 to a fully configured Prestel editor terminal at about £2000. For more information on this system contact Technalogics at 8 Egerton Street, Liverpool, Merseyside or ring on 051–724–2695.

COMMODORE MOVE

As of July the first CBM have occupied new headquarters at 181 Leith Road, Slough, Berkshire. Telephone Slough 71229 and 71162. With this move they have disposed of the Eaglescliffe factory and hope to be able to supply a better and more centralised service. No indication has been given as to the fate of the shop in Euston Road.

GIVE YOUR PET A TOOLKIT

We have received a new piece of firmware for the Commodore PET from Petsoft called the Basic Programmers Toolkit. It is available as either a plug-on extra for old ROM machines or as a plug-in IC for new ROM ones. Based on a 2K ROM with machine code programs it gives you all those useful utilities at a single command. Facilities provided include automatic line numbering, bulk deletion, renumbering, HELP, trace and single step, automatic program building from tapes, dump, find and unlist. The last command makes your program listing secure, it cannot be accessed!

Available in September from Petsoft it will cost £75 for plug-on and £55 for the IC. A full review of the product will be published in next month's issue but from our preliminary tests it looks to be a very powerful and useful addition to any PET.

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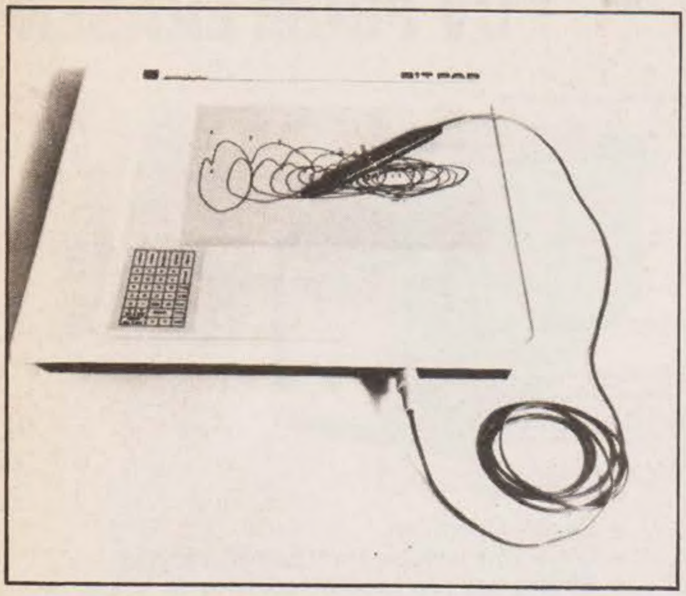

UPDATED DIGITIZER

Terminal Display Systems have recently introduced the Bit Pad One. Described as a general purpose digitizer the new unit contains both the control electronics and the tablet in one unit. The size is 395mm square and 41mm high. Using the magnetostriction principle to give reliable operation through a range of materials it is available with a variety of interfaces, RS232, 8 bit parallel and IEEE-488. The unit can be used in one of three modes, Point mode for single co-ordinate, Switched mode for multiple sampling and Continuous mode. For more details contact TDS at Hillside, Whitebirk Estate, Blackburn, Lancs BB1 5SN or ring 0254-662244.

HARD AND SOFT APPLES

Keen Computers are now stocking the USCD Pascal Operating System for the Apple II. Comprising an Editor, Compiler and Assembler it allows full use to be made of this language for business, scientific and educational purposes. New Apple hardware includes Supertalker, a hardware speech synthesiser, Apple Clock and Romplust. The Apple Clock is also available from Personal Computers.
Keen are at 5 The Poultry, Nottingham. Tel 0602-583254 and Personal Computers are at 194-200 Bishopsgate, London EC2M 4NR. Tel 01-283 3391.

ANOTHER STAR ARISES

Star Devices of Newbury, whose touch keyboard we reviewed in April, have released a new, improved version. The device features 7 bit parallel ASCII output with optional parity and positive and negative strobes. Each of the 128 ASCII codes has a unique key and the code is displayed on a row of seven LED's. The PCB lettering has been replaced by back printing on the pads. All the options for serial output, RS232 or 20 mA, open collector, active low and on board regulation have been retained as has the auto scan and bleep facility. The price stays the same too at £37.50 plus VAT. For more details contact Star Devices at PO Box 21, Newbury, Berkshire or ring Newbury 40405.

TRS-80 SOFTWARE NEWS

A neat little booklet arrived the other day from 3 Line Computing. Priced at £1, it contains a text editor program called Textman, complete with listing, a review of Newdos+ and a game called Tank Battle, again with a complete listing. As well as all this they have included some useful routines, an editorial and a list of other available software.

Full marks for both effort and presentation must be given to the authors Tim Hill and Fred Brown as this must rate as one of the best software services I have yet seen. For further details contact them at 421 Endike Lane, Hull HU6 8AG.

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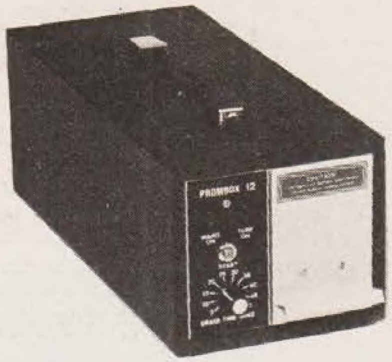

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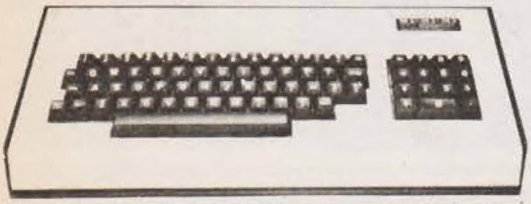

Price £95.00 (mail order total £115.00) 25-way D-Type connector for KB771 £4.25 (mail order total £5.46).

		Mail order total
KB756 56-keystations, mounted on PCB	£49.50	£58.65
KB756MF, as above, fitted with metal mounting frame for extra rigidity	£55.00	£64.98
Optional Extras:		
KB15P Edge Connector	£3.25	£4.31
KB701 Plastic Enclosure	£12.50	£15.24
KB702 Steel Enclosure	£25.00	£30.48
KB710 Numeric Pad	£8.00	£9.78
KB2376 Spare ROM Encoder	£12.50	£14.95
DC-512 DC/DC Converter	£7.50	£9.20

Quantity discounts available

All the above keyboards are fully TTL-compatible, providing the full 128 ASCII character set, and requiring +5V –12V Power Supply. Full technical data and circuit diagrams supplied.

SEALECTRO PATCH BOARDS

Programme boards for switching and interconnecting input/output circuits. 11 × 20 XY matrix. Interconnection is by means of shorting Skip and component holding pins (not included). Dimensions: 7½" × 5¾" × 1".

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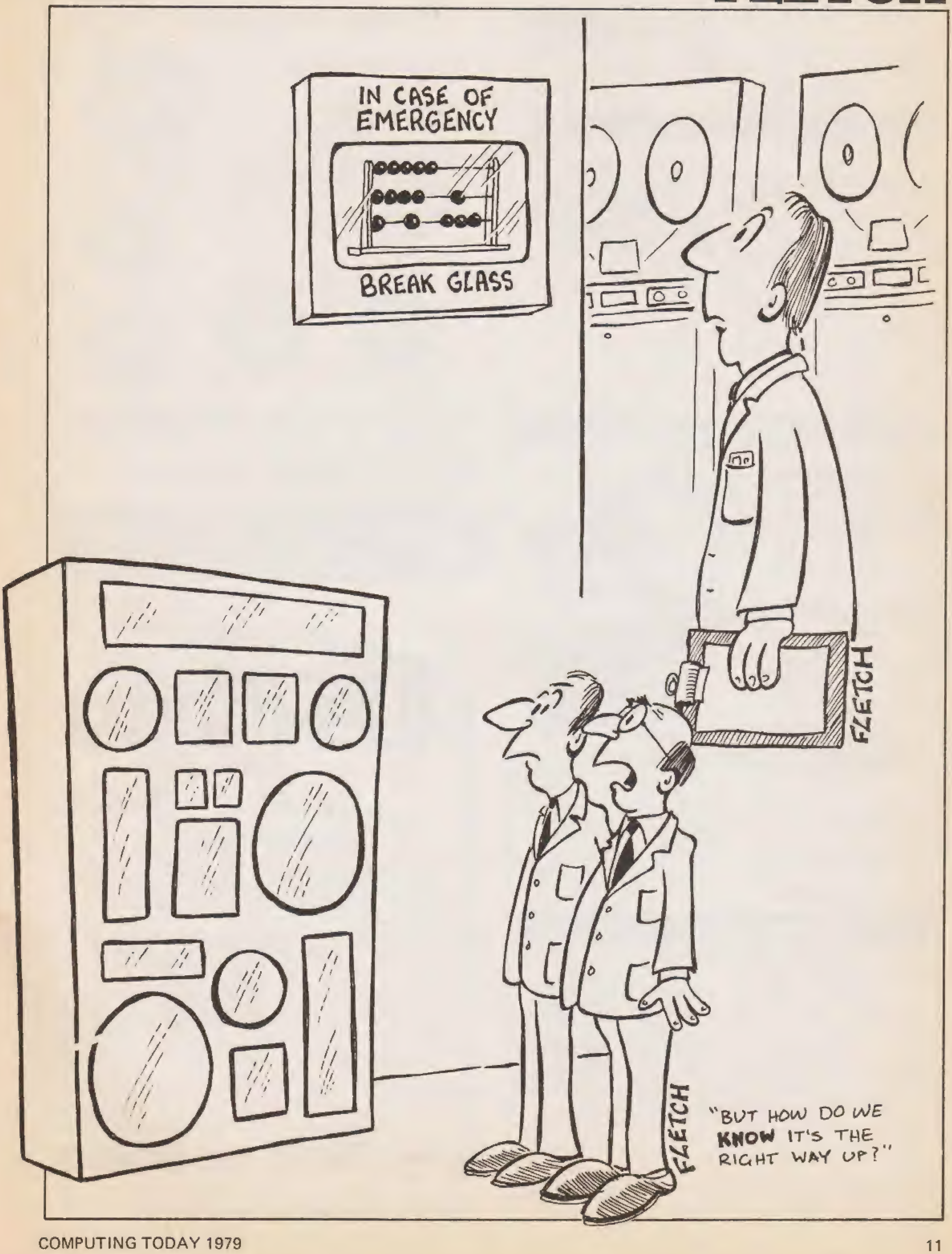
IN CASE OF EMERGENCY
BREAK GLASS
FLETCH
FLETCH
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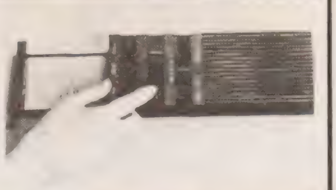

T.V. GAMES

PROGRAMMABLE £29.50 + VAT.
COLOUR CARTRIDGE T.V. GAME.

The TV game can be compared to an audio cassette deck and is programmed to play a multitude of different games in COLOUR, using various plug in cartridges. At long last a TV game is available which will keep pace with improving technology by allowing you to extend your library of games with the purchase of additional cartridges as new games are developed. Each cartridge contains up to ten different action games and the first cartridge containing ten sports games is included free with the console. Other cartridges are currently available to enable you to play such games as Grand Prix Motor Racing, Super Wipeout and Stunt Rider. Further cartridges are to be released later this year, including Tank Battle, Hunt the Sub and Target. The console comes complete with two removable joystick player controls to enable you to move in all four directions (up/down/right/left) and built into these joystick controls are ball serve and target fire buttons. Other features include several difficulty option switches, automatic on screen digital scoring and colour coding on scores and balls. Lifelike sounds are transmitted through the TV's speaker simulating the actual game being played.
Manufactured by Waddington's Videomaster and guaranteed for one year.

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PLAY CHESS AGAINST YOUR PARTNER.

using your own TV to display the board and pieces. Star Chess is a new absorbing game for two players, which will interest and excite all ages. The unit plugs into the aerial socket of your TV set and displays the board and pieces in full colour (or black and white) on your TV screen. Based on the moves of chess. It adds even more excitement and interest to the game. For those who have never played, Star Chess is a novel introduction to the classic game of chess. For the experienced chess player, there are whole new dimensions of unpredictability and chance added to the strategy of the game. Not only can pieces be taken in conventional chess type moves, but each piece can also exchange rocket fire with its opponents. The unit comes complete with a free 18V mains adaptor, full instructions and twelve months guarantee.

CHESS CHALLENGER 7 – £85.65 + VAT.
PLAY CHESS AGAINST THE COMPUTER.

The stylish, compact, portable console can be set to play at seven different levels of ability from beginner to expert including "Mate in two" and "Chess by mail". The computer will only make responses which obey international chess rules. Castling, en passant, and promoting a pawn are all included as part of the computer's programme. It is possible to enter any given problem from magazines or newspapers or alternatively establish your own board position and watch the computer react. The positions of all pieces can be verified by using the computor memory recall button.
Price includes unit with wood grained housing, and Staunton design chess pieces. Computer plays black or white and against itself and comes complete with a mains adaptor and 12 months guarantee.

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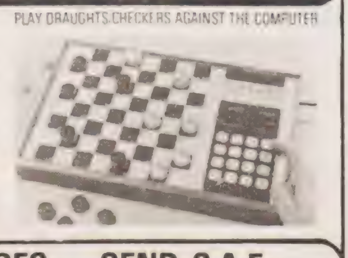
PLAY DRAUGHTS/CHECKERS AGAINST THE COMPUTER



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ABS	HOPOS	ON GOTO	RIGHT$
AND	IF	ON GOSUB	RND
ASC	INPUT	OR	RUN
CALL	LEFT$	PEEK	SAVE
CHR$	LEN	POKE	SGN
DATA	LET	POS	SIZE
DIM	LIST	PRINT	STEP
EXOR	LOAD	PUT	STOP
FOR	MID$	READ	TAB
GET	NEW	REM	TO
GOSUB	NEXT	RESTORE	TRACE
GOTO	NOT	RETURN	

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SOFTSPOT

Heads, Tails Or Draw

Gives the odds A against B. If a draw is not required change step 50.

```
10 INPUT "ODDS:"A,"AGAINST"B
20 X=RND(A),Y=RND(B)
30 IF X>Y PRINT "HEADS"
40 IF Y>X PRINT "TAILS"
50 IF X=Y PRINT "DRAW"
60 GOTO 10

or:
50 IF X=Y GOTO 20
```

Golf Game

This program displays the trajectory of a golf ball aimed at a hole placed in a random position. A parabolic bounce has been simulated and the hole can only be hit on a bounce. The input Y is the stroke from 3 to 10 depending on how far away the hole is. The program has been made deliberately difficult. This can be made easier by changing step 20 to F=2*RND(22);VDU F,15. To speed up the game omit step 100.

```
10 VDU 0,12; FOR X=1 TO 100; NEXT X
20 F=980+RND(44);VDU F,15
30 A=961; INPUT Y   (How hard the ball
                      is hit,3 to 10)
40 FOR W=1 TO 5
50 C=-1,D=-64, Z=Y
60 FOR X=1 TO (2*Y)+2
70 VDU A,18; B=A
80 A=A+2+(Z*D),Z=Z+C
90 IF Z=0 C=1,D=64
100 FOR S=1 TO 30; NEXT S
110 VDU B,32
120 IF Z-1=Y GOTO 140
130 NEXT X
140 Y=Y/2
150 IF A=F VDU F,121; PRINT "HOLE IN
    ONE";GOTO 170
160 NEXT W
170 FOR S=1 TO 1000;NEXT S;GOTO 10
```

Double Die

This displays the throw of two dice. To obtain the next throw press any key and carriage return.

```
10 VDU 0,12; C=275
20 FOR X=1 TO 2; A=RND(6), B=A
30 IF B>=2 B=B-2
40 IF B>=2 GOTO 30
50 IF B=1 VDU C,16
60 IF A>1 VDU C-132,16;VDU C+132,16
70 IF A>3 VDU C-124,16;VDU C+124,14
80 IF A>5 VDU C-4,16; VDU C+4,16
90 C=C+610;NEXT X
100 INPUT X; GOTO 10
```

Word Race

Three worms scuttle across the screen. The computer indicates win and draws. Something to take bets on.

```
10 VDU 0,12
20 A=321,B=641,C=961,T=0
30 Y=A;GOSUB 130;A=A+D
40 Y=B;GOSUB 130;B=B+D
50 Y=C;GOSUB 130;C=C+D
60 IF A=376 PRINT "A WINS";T=T+1
70 IF B=696 PRINT "B WINS";T=T+1
80 IF C=1016 PRINT "C WINS";T=T+1
90 IF T>1 PRINT "DRAW"
100 IF T=0 STOP
110 NEXT X
130 FOR Z=Y TO Y+7 STEP 2
140 VDU Z,113 VDU Z+1,114
150 NEXT Z
160 D=RND(2);D=D-1
170 VDU Y,32;RETURN
```

Maths Quiz

For those of you with jaded mental arithmetic due to excessive use of pocket calculators this program will help rejuvenate those dormant braincells. Range of numbers input lets you select the level of the quiz. (12 for kiddies and morons and 100 for intellectuals).

```
10 PRINT"MATHS QUIZ"; INPUT"RANGE OF
   NUMBERS"X
20 INPUT"ADDITION(A) SUBTRACTION(S)
   MULTIPLICATION(M) DIVIOSION(D)" K
30 IF K=A GOTO 70
40 IF K=S GOTO 100
50 IF K=M GOTO 130
60 IF K=D GOTO 160
70 P=RND(X),Q=RND(X),Y=P+Q
80 PRINT P,"PLUS",Q; INPUT "="Z
90 GOSUB 190; GOTO 70
100 Q=RND(X), Y=RND(X), P=Q+Y
110 PRINT P,"MINUS",Q; INPUT "="Z
120 GOSUB 190; GOTO 100
130 P=RND(X), Q=RND(X), Y=P*Q
140 PRINT P,"TIMES",Q; INPUT "="Z
150 GOSUB 190; GOTO 130
160 Y=RND(X), Q=RND(X), P=Y*Q
170 PRINT P, "DIVIDED BY",Q; INPUT "="Z
180 GOSUB 190; GOTO 160
190 IF Z=Y PRINT "CORRECT"; RETURN
200 PRINT "WRONG. THE ANSWER IS",Y;
    RETURN
```

Mr. D.M. Scales

We examine the facilities of the new Triton V5.1 BASIC Interpreter

The extended BASIC Interpreter contains several new commands which greatly increase the power of the Interpreter. These extensions enhance the editing features, improve the exit, allow stop and start of printout, and give the programmer greater access to all areas of memory and input output ports. They also allow the BASIC to interface with machine code subroutines.

Direct Command Extensions

The control C exit from the BASIC Interpreter has been extended to improve it. When control C is used during program execution, control is returned to the BASIC Interpreter rather than the Monitor. When control C is used during program coding or editing, control is then returned to the Monitor. Two extra control commands have been added to the keyboard routine. These are:

Control S can be used to stop BASIC printout.
Control Q is used to restart the BASIC printout again.
During Control S, Control C can be used to exit to the Monitor.

Example
Enter the following program into Triton:–

```
10 FOR   I = 1 to 10000
20 PRINT I
30 NEXT I
RUN
```

Now, while the program is printing on the screen, press the control and the S key together. This should stop the printout. To start the printing again press the control and the Q key and it should start. Now press control S again and when it stops press control C to exit to the monitor.

Edit

EDIT allows the programmer to EDIT a line of BASIC code. EDIT 100 will print statement 100 and place the cursor on the first character of the statement after the statement number. By typing in new characters, the old statement can be changed by replacement.

Not all characters have to be changed, by using control I and control H the cursor can be forward and backward spaced along the line to the required characters.

Example
Enter the following code
100 ABCDEFGHIJ
then EDIT 100
the Interpreter will print
100 ABCDEFGHIJ
The cursor is under the A. Now type in 123456, followed by LIST. The interpreter will print

TRITON BASIC

Our Triton running a BASIC program under the Humbug V5.1 monitor.

---

100 123456

Now EDIT 100 again

This time type control I three times followed by ABCD Return and LIST again. The Interpreter will print

100 123ABCD

This example shows replacement with shorter code and partial replacement with extra code. It is also possible to delete characters using the Delete Key, insert by using the Escape key, followed by the character to insert, and to terminate the Edit part of the way along the line without deleting the rest of the line, by using control]

Example

Enter the following code

100 ABCDEFGHIJ

then EDIT 100

Now press the Delete key twice, this should delete the characters A and B.

Now press control I twice and position the cursor under the E

Now press the Escape key followed by W

This will place the W between the D and E

Now press Return followed by LIST

The line should now read

100 CDW

Repeat all the above instructions except after inserting the W press control] instead of Return.

The line should now read

100 CDWEFGHIJ

This example shows deletion and insertion and how the EDIT command can be used to change characters in the middle of a statement without completely retyping it.

Command Extensions

Five new commands have been added to the BASIC Interpreter together with spare commands and dummy entries to enable further user extensions.

CALL

The CALL command is used to call a machine code subroutine. CALL 8 will call the subroutine at decimal address 8. (This subroutine will clear the screen and return after the appropriate delay).

The subroutine location can be numeric, a variable or an expression.

```
10 LET A = 9432
20 CALL A + 48
```

This will call a subroutine at decimal location 9480 (For decimal to hexadecimal and hexadecimal to decimal conversions use the B monitor function).

PEEK

The PEEK command is used to copy any two bytes of memory into any of the Tiny BASIC Variables.

```
10 PEEK 8192, C
```

This statement will copy the contents of decimal Memory locations 8192 and 8193 into the variable C.

The memory address can be numeric, a variable or an expression.

Example

```
10  FOR I=O TO 1024 STEP 16
20  FOR J=I TO I+14  STEP 2
30  PEEK J,D
40  E=O; IF D < O D=32767+D+I, E=I
50  A=D/4096,D=D-A*4096
60  B=D/256,  D=D-B*256
70  C=D/16,   D=D-C*16
80  IF E=I      A=A+8
90  Z=C;GOSUB 200
100 Z=D;GOSUB 200
110 Z=A;GOSUB 200
120 Z=B;GOSUB 200
130 PRINT '
140 NEXT J
150 PRINT
160 NEXT I
170 STOP
200 IF Z < 10 PRINT #1,Z,;RETURN
210 VDU 0, 55+Z
220 RETURN
RUN
```

This example uses PEEK to enable BASIC to list the first part of the Monitor in a Hexadecimal Dump. Note the STEP 2 on statement 20 to index the address by 2 bytes each time.

POKE

The POKE command is used to write a numeric value, the contents of a variable or the result of an expression into any two bytes of memory (RAM).

```
10 POKE 7680,C+12
```

This statement will copy the contents of variable C plus twelve into decimal memory locations 7680 and 7681.

Example

```
10  FOR   @(1) = 1 TO 26
20  POKE  @(1) * 2 + 5249, @(1)
30  NEXT  @(1)
40  INPUT 'ENTER ANY LETTER' @(1)
50  PRINT 'THE LETTER IS NUMBER',#1,@(1),'IN THE
    ALPHABET'
60  GOTO 40
RUN
```

This example uses POKE to initialize all the BASIC variables A to Z with 1 to 26.

READ

The READ command enables the BASIC user to read information from any port on his system into any of the Tiny BASIC Variables.

```
10 READ 16, @(1)
```

This statement will read a byte from port 16 and place it in the variable @(1). Note that the high order byte is zeroed and the data is placed in the low order byte.

The port number is the least significant byte of a numeric constant, a variable or an expression. The data must be read into a variable.

Example

```
10  READ O,A
20  IF A > 127 GOTO 10
30  READ O,A
```

Other BASIC Options

As well as the extra options just described, the Tiny BASIC Interpreter has four spare commands and six dummy entries in its various tables. These enable the user to test new BASIC commands before burning them into an EPROM.

Two of the spare commands are called SPRA and SPRB and are found in the main command table TAB2. They are used in BASIC by just coding

```
10 SPRA
20 SPRB
```

When these are encountered by the Interpreter, it branches to addresses in high core. For SPRA the interpreter jumps to 1FFD and SPRB to 1FFA. At these addresses there is room for three bytes to contain a jump instruction to the appropriate machine code extension. At the end of the machine code extension should be a jump to FINISH in the interpreter at address 090B.

The extensions can make full use of the interpreter routines using CALL's. Examples of the use of these routines can be obtained by examining VDU, PEEK and POKE in the BASIC listing.

Variables and expressions can follow the command as long as the machine code routine decodes these and leaves the DE register pair pointing after them.

```
10 SPRA 5,X+3
```

The parameters 5 and X+3 can be decoded using CALL EXPR in the BASIC. The two other spare commands are found in the function table TAB3. SPRC jumps to 1FF7 and SPRD jumps to 1FF4. These can be used to test new functions

```
10   B = SPRC(A,B)
```

This is an example of how SPRC could be coded.

Example

This example uses SPRC(A,B) to perform MOD(A,B). Using the P monitor function. Enter the following program:

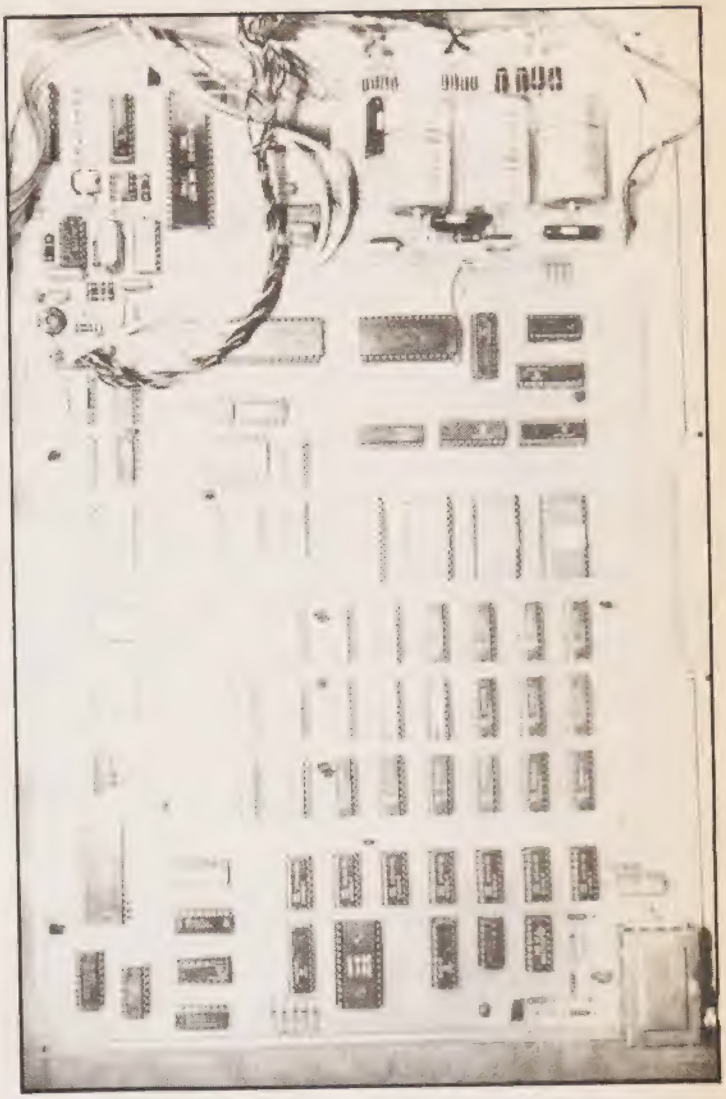
```
1E00    CDBD09    MOD    TSTC    '(',ERR
1E03    28
1E04    13
1E05    CD5D07           CALL    EXPR
1E08    E5               PUSH    H
1E09    CDBD09           TSTC    ',' ,ERR
1E0C    2C
1E0D    0A
1E0E    CD6108           CALL    PARNP
1E11    EB               XCHG
1E12    E3               XTHL
1E13    CDB008           CALL    DIVIDE
1E16    D1               POP     D
1E17    C9               RET
1E18    C33209    ERR    JMP     QWHAT
```

The using P again enter this jump instruction

```
1FF7    C3001E           JMP     MOD
```

Now enter the BASIC program

```
10  INPUT 'ENTER A NUMBER'A
20  FOR I=1 TO 10
30  B = SPRC(A,I)
40  IF B=0 PRINT  #1,A'IS DIVISIBLE BY', I
50  NEXT I
60  GOTO 10
```



The guts of the Triton single board computer. The four labelled IC's centre right hold the Humbug Monitor, reviewed in June, and the Extended Tiny BASIC that we are reviewing in this article.

The dummy entries are found in TAB2, 3 and 6. The names are coded as 7F7F7F7F and the addresses as FFFF. This enables the user with an EPROM Burner to modify these without needing new EPROMS. Do test any new routines VERY carefully before modifying your EPROMS.

```
40  IF A < 128 GOTO 30
50  A=A–128
60  B=A
70  IF A > 96  B=B–32;GOTO 90
80  IF A > 64  B=B+32
90  VDU 0,B
100 GOTO 10
RUN
```

This example reads a character from the keyboard and prints it on the screen. Statements 10 and 20 check that no key is

depressed by looping until the strobe bit (the high order bit) is off. Once this is so, the program loops on statements 30 and 40 waiting for a key to be pressed.

When a key is pressed, the strobe bit is removed and the input corrected for the shift bias of the keyboard. The character is displayed using VDU.

READ can also be used to examine the keyboard in 'Real Time'. This enables the user to write Interactive programs.

WRITE

The WRITE command enables the BASIC user to write a byte of information to any port on his system.

```
10 WRITE 64, D*2
```

This statement will write the least significant byte resulting from the expression D*2 to port 64.

The port number is the least significant byte of a numeric constant, a variable or an expression. The data must be read into a variable.

Example

```
10  PRINT 'THE TRITON LIGHT SHOW'
15  FOR J=I TO 30
20  A=I
30  FOR I=1 TO 8
40  WRITE 3,A
50  A=A*2
60  NEXT I
65  NEXT J
70  FOR I=1 TO 500
75  FOR J=1 TO 75;NEXT J
80  WRITE 3,73
85  FOR J=1 TO 75;NEXT J
90  WRITE 3,146
95  FOR J=1 TO 75;NEXT J
100 WRITE 3,36
110 NEXT I
RUN
```

This example will run two patterns through the LED's on port 3.

Intercept Jumps

To allow the user further access to the BASIC, there are five jump instructions coded into RAM. When the BASIC gets to the end of TAB2, 3 or 6 without a match, it jumps out of the interpreter to one of these jumps before returning to the appropriate error or default routines. These jumps can be modified to jump to Machine Code routines before going to the error exit.

TAB2 jumps to address 1471
TAB3 jumps to address 1474
TAB6 jumps to address 1477

The other two jumps are for BASIC IN and BASIC OUT.

BASIC OUT jumps to address 147A before jumping to the monitor. BASIC IN jumps to address 147D before jumping to the monitor. If different routines are coded for these, the routines should not corrupt registers D and E. To return to BASIC use the RET instruction. Note that the jump instructions are restored in RAM only when the memory check is used.

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It was way back in October 1979 though that the famous Computing Today magazine produced what is still the definitive version today. And all in 2½K as well! (present day GOTO commands use 5K remember) Copies of this program are still available from Trantor library at 1M5 credits. Of course those fortunate enought to have ancestors who bought the original . . . .

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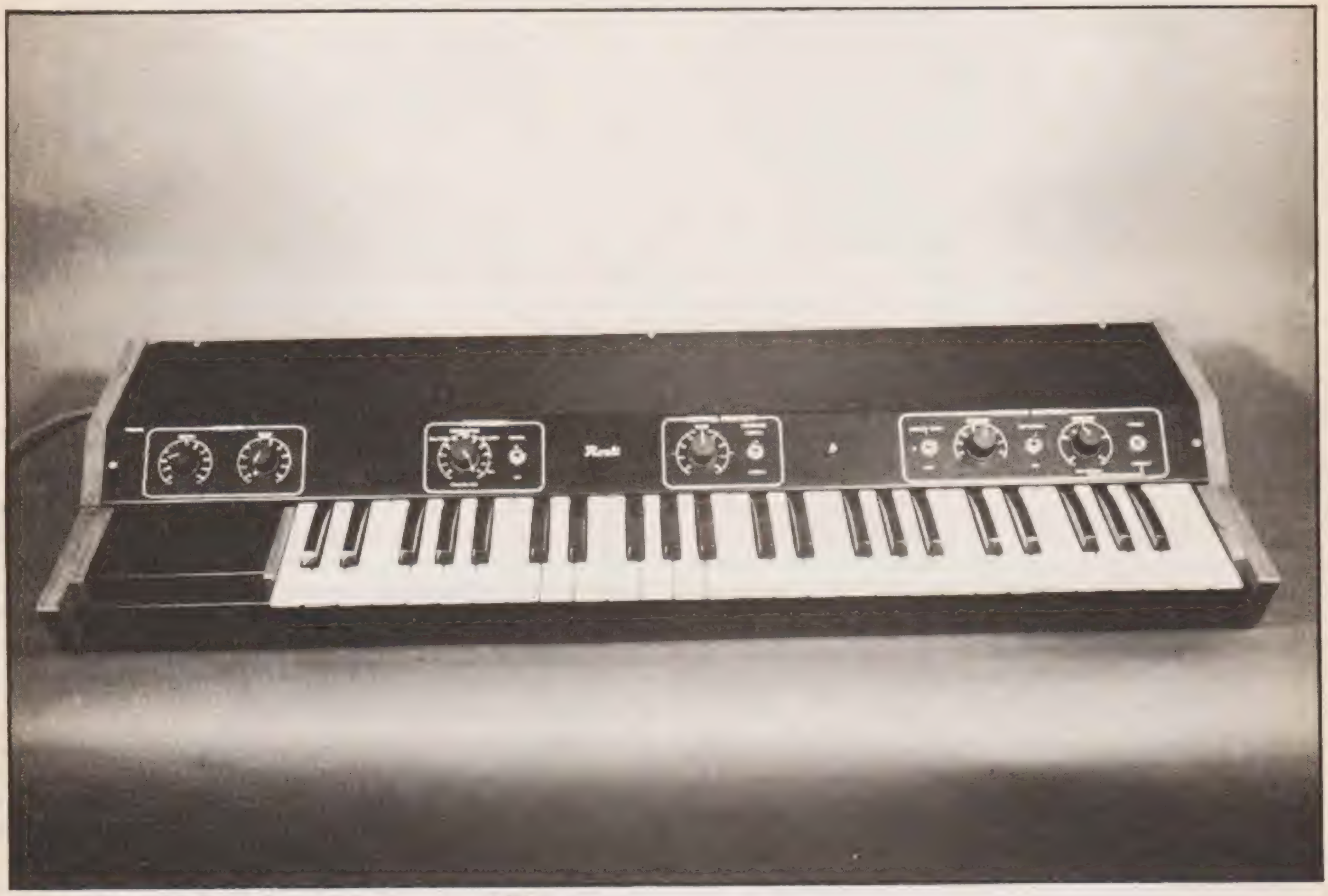


Photo 1. The Arak VIII polyphonic keyboard controller.

Use your micro to control ETI's Arak VIII polyphonic keyboard controller. How? Read on! Tony Keane will explain all

The generation and manipulation of music is one of the most interesting applications of the computer. This article explains one method of doing this using the ARAK VIII as an interface, (see July edition of ETI).

The ARAK VIII is an eight channel polyphonic keyboard controller, primarily developed for use with music synthesizers, which gives out the necessary control voltages and gate signals for controlling a set of voices (to be explained). It also has an interface so that a computer connected to the unit can read all the notes being pressed, or write pitch and gating data to the voices.

How It Can Be Done

There are two basic ways that a computer can generate music. The first method is to generate all the waveforms within the computer and output them as a continuous set of samples through a D—A convertor. The problem is that these samples must come out every 25 us or faster which does'nt give much time to calculate each sample. The average microprocessor system would be unable to cope with one channel using this method let alone eight.

This leaves the second method which is simply to control the voices previously mentioned by providing the necessary control voltages and gate signals, which takes very little computer time.

What Is A Voice?

The standard interconnection of circuit modules shown in

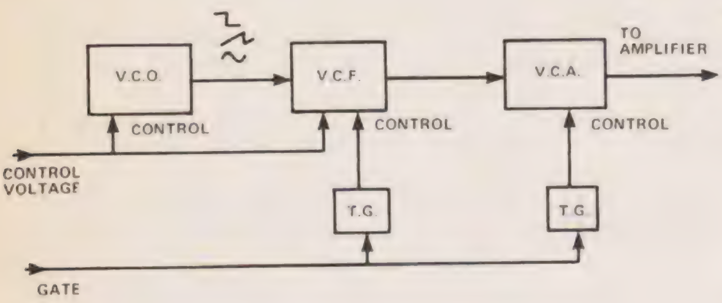


Fig.1. Block diagram of a "voice".

Fig. 1 has become known as a voice. Correct adjustment of each module will allow the synthesis of almost any musical instrument, including a lot of instruments that don't exist.

The raw sound for the voice comes from the voltage controlled oscillator which will have a selection of output waveforms such as sawtooth, square or sine waves. This waveform is given a new tonal quality by the voltage controlled filter, and an envelope shape by the voltage controlled amplifier and transient generator combination. The voice is triggered and gives out a sound when the gate input goes high. The sound dies away when the gate input goes low. The rate at which the sound builds up and dies away is set on the transient generator. The other transient generator shown in the diagram allows a similar thing to be done with the tonal quality.

The pitch of the voice is altered with a control voltage normally scaled such that one volt will change the pitch through one octave. The tonal quality can be kept constant by injecting this same control voltage into the filter.

Real Time Clock

It is possible to create the necessary time length for each note to be played (crotchet, quaver etc.) using software time delays. This is however very inefficient since the times are generally greater than 1/10th of a second during which the computer would be totally tied up. The best method is to use a real time clock, which is simply an oscillator having the same period as the shortest note to be played (probably a demi-demi- semi quaver). The computer uses multiples of this clock period to measure out the correct time for each note. A further advantage is that simply adjusting the clock frequency will change the play back rate of the music.

The Arak VIII As An Interface

Fig. 2 shows how the Arak VIII fits into the system. Data appears at the interface each time one scan of the keyboard has been completed. During data block (see Fig. 3) each of the eight channels are sequentially placed on the interface. The notes being pressed are represented by a 6 bit code called the note code, 000000 being the lowest note on the keyboard. This code is increased by one for each increase of one semitone.

All the computer has to do to read data from the keyboard is sample the states of the gate output and note code on the falling edge of data valid. The data valid signal can either be polled by the computer or used as an interrupt. Since the data comes out at a relatively low rate the interrupt method will give greater efficiency as the program can continue running between the data valid pulses.

When notes on the keyboard are pressed the voices will be activated and give out the corresponding sound. If the computer pulls the enable input high the note code and gate data lines go tri-state allowing the computer to inject its own data to control the voices.

The control voltages are stored in analog form and therefore require refreshing at least every tenth of a second.

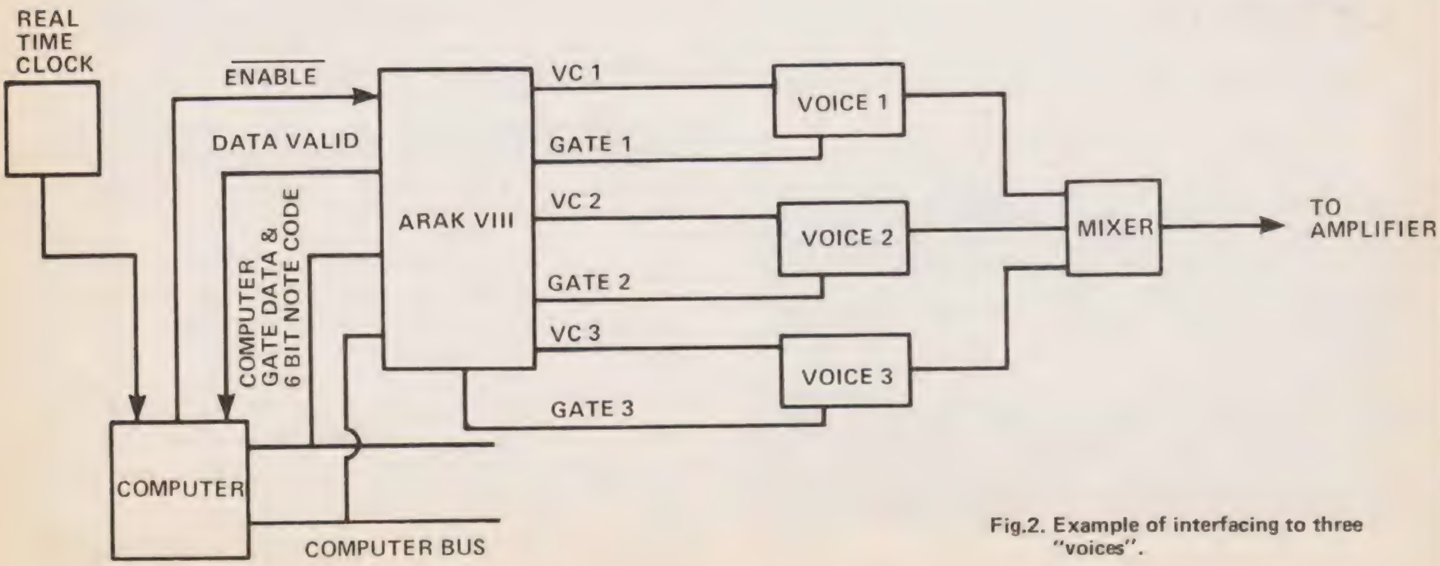


Fig.2. Example of interfacing to three "voices".

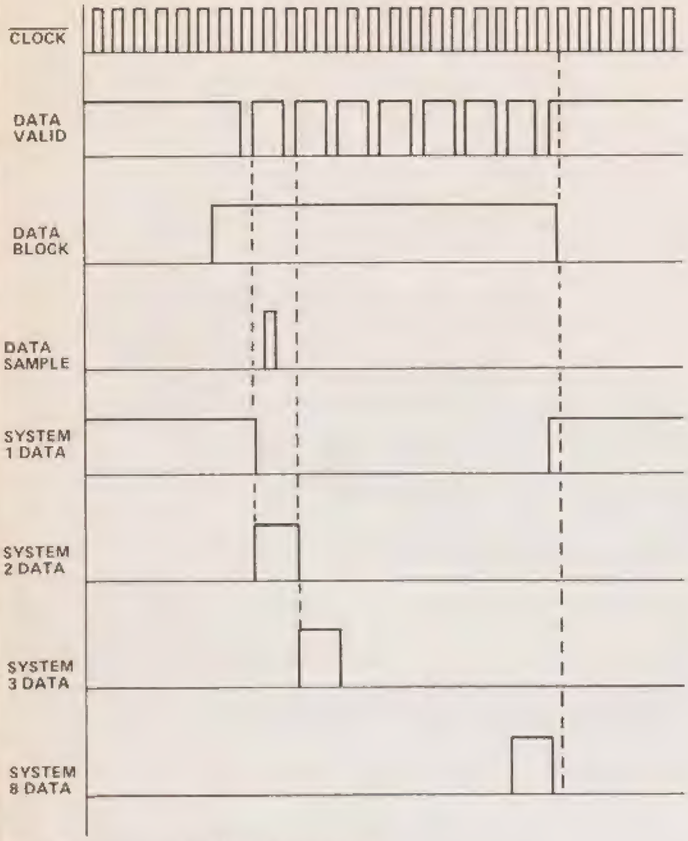


Fig.3. Computer interface timing signals.

The gate data is however stored in a digital latch, and does not require refreshing. The data sample pulse in Fig. 3 shows when data for channel 2 is transferred from the interface to the output channels. To ensure that the data is correctly transferred data must be held constant during the data sample period for each channel.

Software

Software for music generation can be constructed at several levels of complexity. The most basic software simply makes one voice play a tune. The notes are stored sequentially in a section of the computers memory starting at location B. Two 8 bit memory locations are necessary for each note, the first representing the pitch and the second the length of time the note is to be played for. The flow chart in Fig. 4 shows how to sequence the data out of the memory using the real time clock as a time reference.

The memory locations that contain the note data can either be loaded by hand after the sheet music has been converted into the correct binary coding or a program can be written which times each note relative to the real time clock and loads them into the memory as the music is being played on the keyboard, a sort of digital recording. Any mistakes that are made during the recording can be edited afterwards using software that allows the insertion and removal of notes.

Another way of loading up the memory is to allow the computer to compose its own music. The type of music obtained in this manner is entirely dependant on the musical constraints built into the software. No constraints will give music that is random in pitch and time, whereas with the right constraints the music can be made to conform to the normal harmonic and melodic structures.

Another dimension to the music can be added by giving the computer control of all the parameters in the voices so that it can adjust things such as attack, decay, filter cutoff, waveshape, volume etc.

With a large enough set of voices it is possible to reproduce a symphony or concerto provided you have enough memory.

Full details of Arak VIII are available from Arak Sound Ltd, Preston House, High Street, Crowthorne, Berks.

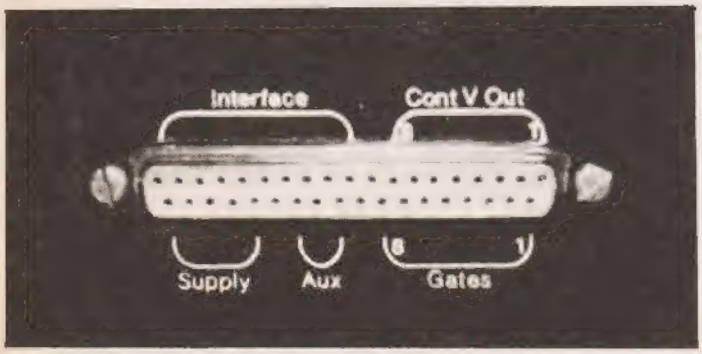
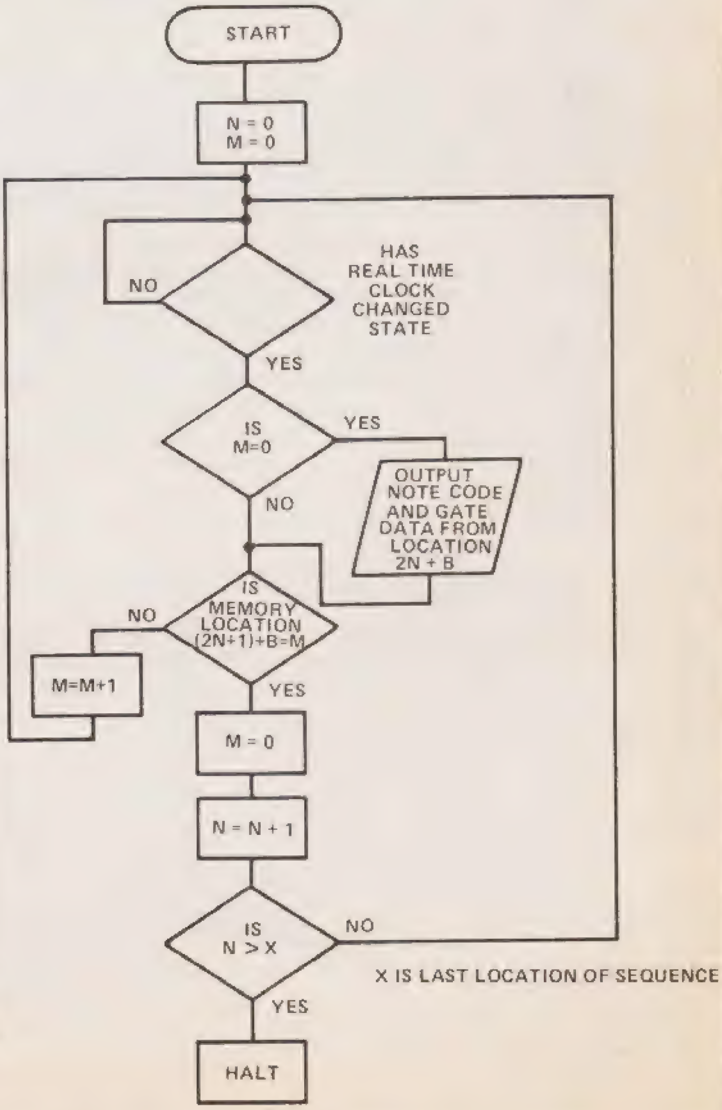


Photo 2. The rear panel of the controller showing the sockets for connection to external equipment.

Fig.4. Sequencing data from computer memory to play a tune.



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Extras

- Available expander board features 24K static RAM (additional mini-floppy interface, port adapter for printer and modem and OSI 48 line expansion interface.
- Assembler/editor and extended machine code monitor available.

Commands

CONT	LIST	NEW	NULL	RUN	

Statements

CLEAR	DATA	DEF	DIM	END	FOR
GOTO	GOSUB	IF...GOTO	IF...THEN	INPUT	LET
NEXT	ON...GOTO	ON...GOSUB	POKE	PRINT	READ
REM	RESTORE	RETURN	STOP		

Expressions

Operators

–, +, *, /, ↑, NOT, AND, OR, >, <, <>, >=, <=, =

RANGE 10^{-32} to 10^{+32}

Functions

ABS(X)	ATN(X)	COS(X)	EXP(X)	FRE(X)	INT(X)
LOG(X)	PEEK(I)	POS(I)	RND(X)	SGN(X)	SIN(X)
SPC(I)	SQR(X)	TAB(I)	TAN(X)	USR(I)	

String Functions

ASC(X$)	CHR$(I)	FRE(X$)	LEFT$(X$,I)	LEN(X$)	MID$ (X$,I,J).
RIGHT$(X$,I)			STR$(X)		VAL(X$)

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MPU's BY EXPERIMENT

Ian Sinclair

Part 3 of our experimental series on microprocessors

This month we're going to creep a bit nearer to your actual genuine microprocessing, so that we'll have to make a few changes on the board. Remember to have the power switched off when you change anything on the circuit board — a useful extra safeguard is to short the + and – lines with a wire link. The first change this month is a minor one — remove the 250 uF which was used as C* and substitute a 25 uF in the same place (C20 to X2), with the negative connection on X2. If you had an LED connected up to monitor the clock pulse rate, you can remove it now because the clock pulse rate will be too fast to monitor in this way. The 2k7 which was the current limiting resistor for this LED can also be taken off the board. If you didn't monitor the clock pulse rate, there's nothing to change at that part of the board.

Speed Your Clock

Now with this much faster clock pulse rate, the effects of leakage should be negligible, and the 8060 should do exactly what its makers say it should. Obviously there are large differences between individual chips of the same type, which show up when such comparatively slow clock rates are used, and if you find that you have some odd effects persisting, you may have to use a smaller value of capacitance, 5 uF or less, as C* in the clock pulse generator circuit. Incidentally, the 8060 has its own built-in oscillator circuitry, but it's suitable only for fast clocking, and doesn't generate slow clock rates with a fast enough rise and fall time. We've used the 74LS132 because it has what is called Schmitt trigger inputs which can generate very fast changing waveform edges from slow-changing ones (Fig. 1).

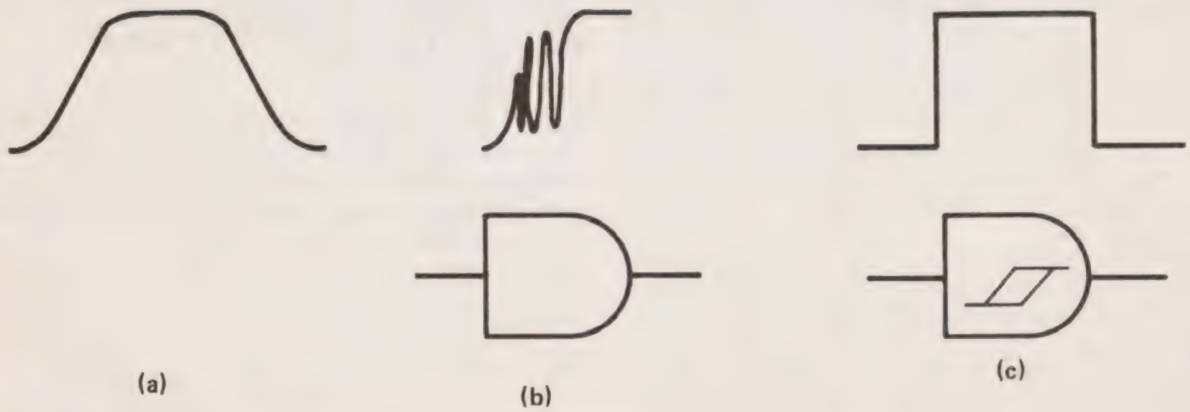
With the alterations made and any shorting links removed, we can plug in to the power supply and prepare to go again. We can now briefly try the same routines as we used with the slow clock rate, but this time with no distractions and a lot faster.

Reset, and set all the DBS low. Cancel reset, watching for the very brief flash from DLED 4, DLED 5 (remember what these signalled?) Address 0001 is now displayed. PUSH, and release quickly, to get the brief flash of DLED 4, DLED 8 (remember?), and the system should now settle with the address 0010 displayed. If you hold PUSH down, you will see the address LEDs generating a binary count at a rate which is much slower than the clock pulse rate. You may also notice that each address is flashed twice — this is a peculiarity of the HALT instruction which you won't see repeated on other instructions. Also with PUSH continually depressed, you can see the alternate flashing of DLED 4, 5 and DLED 4, 8, making up the two parts of the HALT instruction.

With the faster clock pulse, we can make rather more sense of the DELAY instruction which can be programmed into the 8060. Reset, and arrange the data switches to 10001111. Cancel reset, and with address 0001 displayed, PUSH. Now, with address 0010 displayed, change the data switches to 00000001 and PUSH again. All the LEDs will extinguish, and the 8060 starts the delay count. At the end of the count, the next address 0011 will be displayed. Note the time for this delay cycle, and then measure the delay time when 00000010 is entered as the second byte of the instruction. When this faster clock pulse is used, there should be no outputs visible on the status LED's.

Naughty Bits?

Just to show an example of a different way of using a register, the next bit of investigation makes use of the SIN switch. Don't let it excite you, it means Serial in, and it connects to the input on pin 24 of the 8060. The serial input will place a bit into a register called the extension register, and this is done once by an instruction called Serial Input/Output (SIO). This extension register will hold 8 bits, one byte, and it right-shifts at each SIO instructions. As a bit is



(a) (b) (c)

Fig.1. Clock pulses (a) pulse with slow rise and fall times, (b) effect of a slow rise time on a gate — oscillations break out during the slow rise time (this also happens during the fall time). (c) Using a Schmitt trigger gate to give very fast rise and fall times.

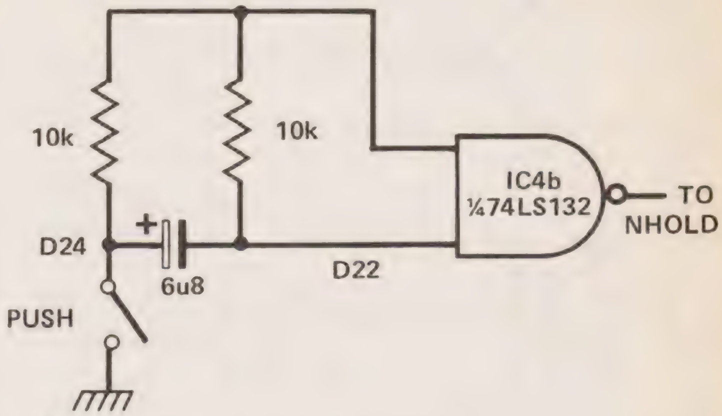


Fig.2. The PUSH modification — this delivers one pulse for each PUSH.

entered from the SIN input to one end of the extension register, the bit at the other end of the register must be shifted out, and this goes to a latch whose outputs is at the SOUT pin. Since we've connected an LED to this pin, we can see the effect of unloading the extension register at each repetition of the SIO instruction.

What we can do to demonstrate this action is to reset, so clearing the extension register (and all others as well), then start loading 1's at the serial input until the register is full. The next SIO instruction will then cause the SOUT LED to light. We can then load 0's into the extension register and shift until the SOUT LED shows a zero again. The 8060 is one of the very few microprocessors which has this facility built-in — most other chips need additional ICs for this serial input/output job.

Start with reset, then set the SIN switch to logic 1 (up, on the prototype circuit). Then set the data switches to 00011001, which is the SIO code. Eight brief pushes (check the address counter to keep a track) will load the extension register, and the ninth will cause the SOUT LED to light, just as it should. Switch SIN to logic 0 now, and count the number of pulses which are needed to cause the SOUT LED to extringuish.

The extension register is not just a way of delaying a bit for eight clock pulses, it can also be used to load the main accumulator register. Try this now. Fill the extension register with logic 1's again by setting the SIN switch to logic 1, setting up 00011001 on the DBS, and pushing until the SOUT LED lights. Ignore the address count for the moment. Now set up 00000001, which is the instruction code for 'Exchange Accumulator with Extension Register'. This one does just what it says — it transfers the byte which is stored in the accumulator into the extension register, and the byte stored in the extension register is transferred onto the accumulator. There's an intermediate register which holds one byte at a time in the middle of this operation to make the exchange possible.

Fully Loaded

We should now have the accumulator register full of logic 1's — how do we prove it? More about this method later, but for the moment, do so by setting up 11001000, PUSH, set up 00000001, PUSH. This should get you to the state where each DLED is lit — though the switches are set to 00000001! The reason is that the microprocessor has stopped at the NWDS stage of a write instruction, and 11111111 is being written out, rather than 00000001 being read in.

Another important point about this procedure is that the data switches have twice been set to 00000001 — once as an instruction (exchange accumulator and extension register) and once as a number (decimal 1). The difference is one of sequence — as we've noted before, the first byte of a pair is always an instruction, the next one may be an instruction or a number. What sets the microprocessor up so as to treat the second byte correctly? It's the order of 1's and 0's in the first byte — nothing magical about it, it simply sets the gates which route the next byte to the correct register. On the 8060, the logic is particularly simple, all the single-byte instructions, which have no number following, start with logic 0; and all double-byte instructions which do have a number following, start with logic 1. Easy, isn't it? All the microprocessor has to do is to compare the highest order bit with 1, and then set the gates which will then route the byte to the correct register (accumulator for a number, instruction register for an instruction) at the next set of clock pulses. At the end of the instruction or the processing of a number, the program counter increments (counts up by one pulse) so as to fetch the next instruction byte from the program memory.

Pushing On

At this stage, the job of jabbing the PUSH button becomes a bit tedious, because if you push for a bit too long, you can count through two instructions. A small adjustment to the circuit will cause the PUSH button to deliver just one pulse per push, even if the push is a long one. The circuit modification is shown in Fig. 2. The push-button switch now has a pull-up resistor of 10k, and connects to the 74LS132 gate input through a capacitor, in this case 6u8. Don't be tempted to use a very small value of capacitor, as the resulting pulse may be then too short to start the cycle — short pulses can be used only when the clock pulse is also short. If we really wanted to be fussy, we would connect the other input of the gate of the clock pulse, but for this application, we can simply connect to the +5 V line. On the Eurobreadboard, the new connections are:

PUSH switch output to D24
D24: 10k to Y2; 6u8 to D22

The positive end of the 6u8 should be on D24, negative on D22. We are now very close to the standard system used for 'one-step' operation of this type of microprocessor, and all the remaining work with the board will be done with the circuit basically as it is now. We can now look at some more useful instructions, and the first set we shall examine are the

(a)

A	B	Q
0	0	0
0	1	0
1	0	0
1	1	1

(b)

```
        1 0 1 0 1 0 1 0
AND     1 0 0 1 1 0 0 1
      =1 0 0 0 1 0 0 0
```

Fig.3. AND-ing. (a) Gate and truth table (b) AND-ing pairs of bits in two bytes.

IMMEDIATE instructions. Each of these instructions is followed by a byte which represents the number that the instruction is to act on. Later in the series we'll look at how numbers from other parts of memory, or from outside the memory system, can be introduced; some of this work has to be done on the MK14.

New Instructions
The first of the IMMEDIATE instructions is LOAD IMMEDIATE, which means simply load into the accumulator register the number byte from the next position in the program memory. To do this, reset, cancel reset, and then switch up 11000100 on the data switches. This is the instruction code LDI, load immediate, on the 8060, and it must be followed by a byte of data. With this set up on the data switches, and the address 0001 showing, PUSH. Address 0010 now shows, and the 8060 is awaiting the number which is to be loaded into it. Load up a set of 1's by setting all the data switches to 1, and then PUSH again. Address 0011 will now show that the instruction has been carried out – but how can we prove it?

One partial proof is to copy the contents of the accumulator to the status register, so that at least the lowest three bits of the number can be checked. The status register contains 8 bits, of which the lowest three have outputs on flags 0, 1, 2 to which we have LED's attached. The other bits in the status register have no direct outputs, and have to be checked in different ways, as we'll see later. We can do the copying act by setting 00000111 on the data switches, followed by PUSH. The instruction byte is CAS – Copy Accumulator to Status, so that all of the status LEDs should be lit.

We can prove that the accumulator is full of 1's in another way, but this one involves losing the data (which at the moment is still stored in the accumulator, since it was only copied to status, not exchanged). There's an instruction which we've just used for exchanging the contents of the extension register with the accumulator. This will fill the extension register with 1's, which can then be shifted out by the SIO operation and counted. The procedure is as follows:

Switch SIN low, and set the data switches to 00000001. Now PUSH, so causing the registers to exchange. Now we can examine the contents of the extension register by setting 00011001, which is the SIO instruction. PUSH, and the first 1 appears on the SOUT LED. Each of the next seven PUSH operations has the same effect, showing that there were eight 1 bits in the register, and the ninth PUSH should produce the 0 to which the SIN switch has been set, proving that we have now cleared the extension register.

There's another method of showing what's in the accumulator register which we've used before and will explain in detail later – this is the method we'll use from now on to show the accumulator contents. Load the accumulator with 1's again by using the 11000100 PUSH 11111111 PUSH sequence; this is necessary because the contents of the accumulator were exchanged with the contents of the extension register, and then shifted out. Set up 11001000, which is a STORE instruction (ST) that will cause the accumulator byte to be placed out on the data lines when a second byte follows. Use PUSH, and then set the switches to 00000001 and PUSH again. This should set all the DLED's to 1, though the DBS switches are not set this way – a proof that it's the contents of the accumulator and not the data input switches that we're looking at.

AND Now For Something . . . . . .
Now for something a trifle more ambitious. Reset, and then cancel reset. Set up 11000100, which is load immediate, PUSH, and follow by 10101010, PUSH. This has loaded the data number 10101010 into the accumulator. The next instruction 11010100 is AND IMMEDIATE, which instructs the 8060 to set up eight AND gates, to AND each bit in the accumulator with the corresponding bit of the next number byte which is fed in from memory. The AND operation is illustrated in Fig. 3; remember that 1 AND 1 is 1, 1 AND 0 is 0, 0 AND 0 is 0. With the AND IMMEDIATE (ANI) instruction code set up, PUSH and load the number to be ANDED, 10011001, PUSH again. The accumulator should now contain the result of the AND-ing, which should be 10001000, and we can check this by using the procedure which will soon become very familiar. Set up 11001000, PUSH, 00000001, PUSH. The readout DLED's should now display the accumulator number, 10001000, just as it ought to be.

These two instructions, load immediate and AND-immediate each take ten micro-cycles, therefore 40 clock pulses, to perform. This sometimes comes as a shock to microcomputer buffs who think that one clock pulse equals one instruction, and it also helps to explain why chips are so often updated to higher clock-pulse rates, or why two-phase clocks are sometimes used. One microprocessor, the Texas TMS9980, even has a four-phase clock. Next month, folks, more IMMEDIATE instructions.

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The Big Memory PETS
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The Dual Drive Floppy Disk is the latest in Disk technology with extremely large storage capability and excellent file management.

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CONSUMER SHOW REPORT

Gerald Chevin

America where are you? A report from the States on their Consumer Show

For the most visitors to the Summer Consumers Electronics Show (SCES) staying one step ahead of the competition is the name of the game, for most people this is "the show" and they would not dream of missing it.

Dateline Chicago

The largest show of its kind in the world, the 13th annual summer CES included more than 900 exhibits in three major facilities — the Pick Congress Hotel, the McCormick Inn and three levels of McCormick Place itself. Registration was estimated at 50,000 by Wednesday closing day.

The exhibits themselves provided a fascinating look at the future — the clamour in McCormick Place arising from thousands of voices explaining products, thousands of fingers activating computer games, and thousands of TV sets running simultaneously.

There were 365 High Fidelity manufacturers exhibiting in the specially designed complex of sound rooms but, the key work seemed to be "Video". Video games, Cassettes and Discs, including X-rated movies were getting lots of attention from the retailers, and distributors who gear-up for the Autumn Season at this show.

Conventional Proceedings

Also, as a national convention the CES offered more than twenty hours of conferences and workshop seminars. One of the major speakers was Mike Toia of the Federal Communications Commissions Laboratory (FCC). He summerised a current state of the electronics industry like this: "We have a technological explosion, which means that any prediction you make will be surpassed by actualities".

Nevertheless, predictions were being made during the course of the three-day show. For example Charles Daigneault of Sharp Electronic Corporation, speaking to a group of retailers, projected 10,000 television sales for next year (USA). He also foresees multiple deluxe features, on deluxe television units as sales boost for the future. "Just what we used to call the family game room became the television room, so we will soon see a home entertainments centre, including video-cassette recorder, projection TV and Hi-Fi system".

The large growing market for video games was discussed by Donald Kingsborough of Atari Incorporated, "The rise in the age of the buyer as entire households become interested has catapulted retail sales of video games, nearly 700,000,000" he said, "in a growing market the buying influence is a family decision — our customers are 50% women", noted Kingsborough. In another area Mattel and Gerrold Electronics in October will jointly test play Cable Inc. Its purpose is to bring games and personal improvement programmes to cable television subscribers. A cable extension rented for less than ten dollars per month will enable a consumer to have a system connected to his home.

Video Discs

Magnavox launched the video disc era in December 1978, in Atlanta, and a limited number of video disc players all imported from its parent company PHILLIPS in Holland, was sold out within minutes. Magnavox soon launched production at its facilities in Tennessee, but could not make a dent in the Atlanta order backlog. In the first ninety days of sales an estimated 300 players were delivered, against firm orders for more than 1,000, and many of their reservations were accompanied by advance payment of the $695 purchase price.

One million is a nice round figure and it seems to be a milestone for the infant home video software business, it is a number which should easily be passed this year according to even the most conservative industry estimates, software suppliers should easily sell more than one million pre-recorded family orientated tapes this year.

Adult X-rated or "Hard Core" should also sell about the same amount, not bad for a three year old business.

Video Games

At the time of the show, a very interesting situation arose. Texas-Instruments have introduced their new personal computer type number TI99/4, and were challenging the FCC with regard to their specification relating to modulator output voltage. TI were convinced that the FCC would change its ruling on the specific waver which up to now limits very strictly the level of output voltage from the RF modulator, consequently all TV game manufacturers have to comply to the FCC ruling. According to Robert Wiles of Bally the cost of this was something in the region of $25 and if reflected on the retail price, could amount to a reduction of $15 per game something of a dramatic figure.

There is also another major problem in relationship to television games; something like 146 different hand-held games on the market at this point. Most of the semi-conductor manufacturers facilities for producing custom chips for

various Video games have been completely absorbed by the ordering of the hand-held game manufactures consequently, it has become much more difficult to quickly get customised ROMs produced for extra games cartirdges so it would appear to be now a situation where only three major contenders. Atari already have an extremely popular home video computer game and plenty of software to go with it, Bally who announced their intentions to definitely stay in the TV games market, and a new-comer Mattell with their television which would appear to be the most sophisticated games system/home computer available (USA only). Since the show it can now be reported that the FCC have rejected the TI's challenge to their output voltage requirements, and the situation is now as before. Some of the features of the Texas Instrument's home computer are listed below:—

Console
CPU:9900 Family, 16-bit microprocessor, plus 256-byte scratchpad RAM MEMORY: Total combined memory capacity: 72K bytes. Internal ROM memory supplied: 26K bytes. External ROM memory' (Solid State Software Command Modules) Up to 30K bytes each. RAM memory supplied: 16K bytes.
KEYBOARD: Staggered Qwerty, full travel style layout. Overlay for second functions.
SOUND: 5 octaves, 3 simultaneous tones plus noise generator. from 110 Hz to beyond 40,000 Hz.
VIDEO RESOLUTION: 192 x 256
POWER: 110V, 60 Hz, 20W. Wall mounted console transformer.
SIZE: 25.9 x 38.1 x 7.1 cm (10.2 x 15.0 x 2.5 in).
WEIGHT: Less than 2.3kg. (5lbs)
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Variety of financial, educational and entertainment programs in rugges, reliable plug-in modules. Modules contain up to 30K bytes of extra ROM.

Hand Held Games
As previously mentioned, with something like 146 different hand-held games available, it is interesting to note that 'Simon' is still the most popular selling game in the USA. One of the most innovative new entries was the MICROVISION, a hand-held mini video game with its own built-in screen, Microvision comes with 'Block-Buster', really break-out in your hand, after you crash through the third row of bricks the ball speeds up and the game becomes a real challenge. Other plug-in ROM cartridges available for Microvision involve Bowling, Pinball, Connect-four, Star-Trek, Phaser-Strike and Mind-Buster, in all seven game cartridges are available to be played on the self-contained LCD screen. Another game, Sensor, is an electronic word game which combines the challenge and excitement of Scrabble with

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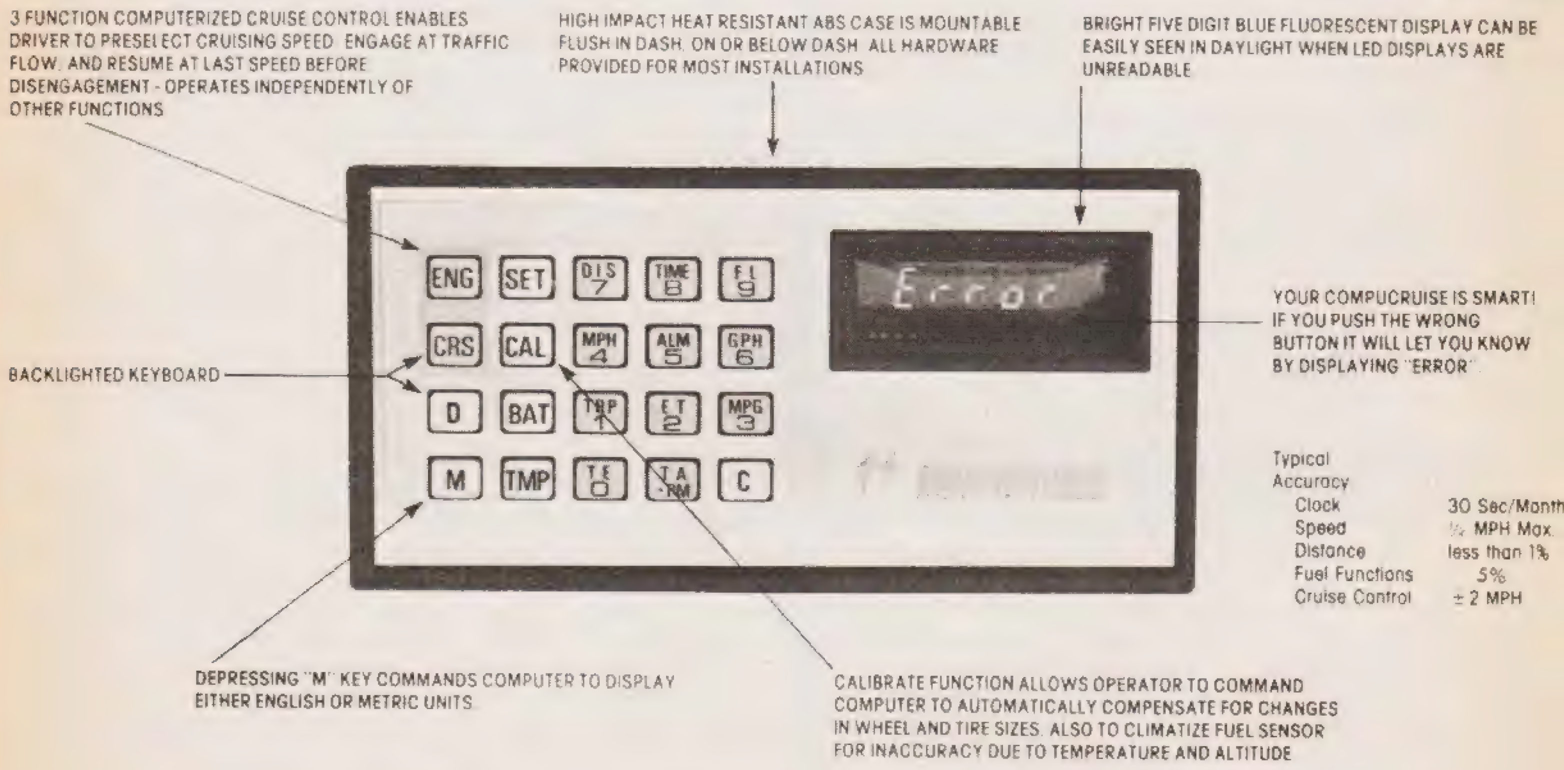


computerised electronics, the object of Sensor is to guess your opponents (or the computers) word in the fewest turns. It can play with two people too. One player punches a word into the computer and the second player deduces the word, letter by letter as the computer flashes clues to the position and accuracy of the guessed letter. A "space age" sound signals a correct deduction. When a player deduces the complete word electronic jingles announce the triumph.

The "Big Trak" toy is a tractor and trailer unit, program controllable of course. Using its own length as a measure of the distance covered it can have up to sixteen program steps. This means that you can move both forward and backward up to ninety nine times the length of the toy. But that's not all! An auto repeat makes it do it again, and you can turn left or right at any angle up to a complete circle. All the operator has to do is estimate the distance of each section on the course he wishes to travel, program the system and let it go.

By using the eight programming commands and the variety of movements available you should be able to spend endless hours of fun chipping the paint from furniture and walls around the house. Be warned, it's coming to England!

As well as possessing all this sophisticated control Big Trak also carries a variety of sound and light "weapons" to knock out the baddies with and can dump loads from its trailer at command. Now is the time to invest in a carpet sweeper!

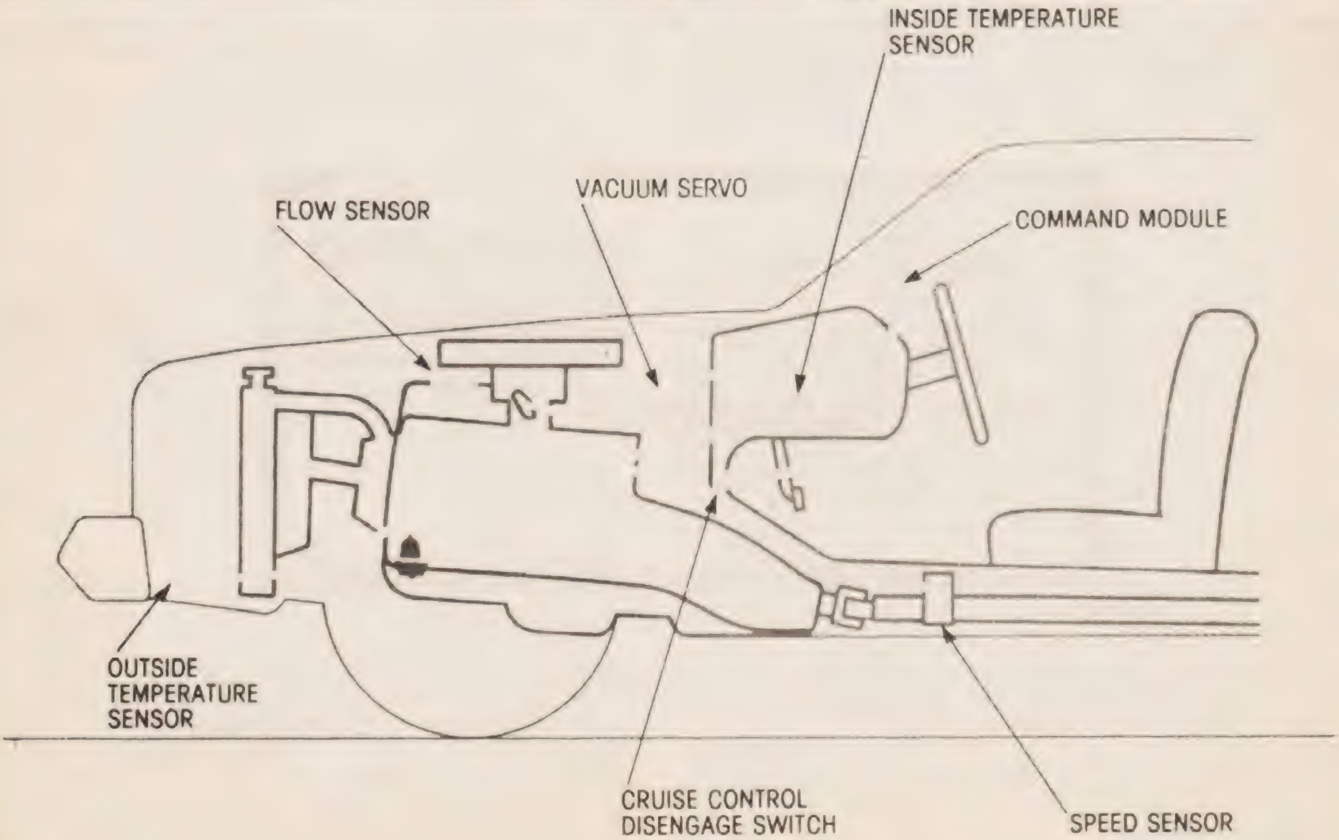
Automobile Accessories

Compucruise is an on-board navigational computer for automobiles, lorries, vans and recreational vehicles. It features cruise control, a fuel management system, a trip computer and a multi-functioned quartz crystal time counter, plus many other functions.

The system uses a microprocessor that can be programmed to step through any sequence of commands: add, subtract, save data, display the results. But digital computers require single pieces of on-off pulses (bits) to work. A spinning drive shaft hardly conforms to this requirement, so transducers (Sensors) are used to convert the mechanical motion into a useable electrical signal.

The most important sensor is called the speed transducer. In the Compu-cruise system, four magnets are glued and taped to the drive shaft. As you move the drive shaft turns, allowing a magnet to pass in front of the coil. When it does, a small voltage pulse is induced in the coil, representing a full or partial turn. Since the drive shaft revolves in proportion to the movement of your car, a specific number of pulses will represent a specific distance.

How much distance? That depends on such things as the Rear axle ratio and tyre size. But that is where the computer power of the microprocessor comes in: before using any of these systems, you make a simple calibration. At the beginning of a measured mile, you push a button. That tells the computer to begin at zero. Then, as you travel the mile stretch, the computer counts the pulses. At the end of the mile, push the button again. The number of accumulated pulses are then stored as a reference base. If, for example, the computer counted eight hundred pulses for the measured mile, it knows that 400 represent one half mile 1,600 mean two miles, and so on, for any distance you travel and all this will automatically take tyre size and other variables into account, since they were part of the original calibration.



The Intellivision home entertainment unit from Mattel. It plays games as well as using software packages for education and home management.

O.K, the computer now knows how far you have gone, but it must also know your speed to do any useful work. To determine it accurately, the system computes it. Since the speed or — RATE — is equal to how long it took you to go a certain — DISTANCE — and the distance is known from the calibration, all that is needed to calculate the speed is the TIME (R = D ÷ T).

For that a quartz digital clock is used, it is simply a circuit that switches on and off at a precise rate, thousands of times a second. Other digital circuits within the clock divide the time down into thousandths, hundredths and tenths, and finally single pulses per second.

The computer can use any of these time bases as a "window" — a single moment in time to count distance pulses from the transducer. If, for instance it counts four pulses during a one tenth of a second window, that is equal to forty pulses per second; two hundred pulses per minute; one hundred and forty four thousand pulses per hour. And, from the original distance calibration, each pulse represented one foot of movement, then you would be moving 144,000 feet per hour or 27.3 miles per hour.

If all that has you confused, don't worry, the computer does it all automatically — every second — and shows the results on a digital display. But that's not all!

Besides the speed transducer, the Compucruise uses a fuel flow transfuser, it too uses pulses that indicate the amount of fuel passing through to the carburettor. And once calibrated by entering in the amount of fuel you have consumed at your next fill-up, along with the capacity of your fuel tank, it is capable of carrying out just some of the following functions:—

The fuel used since fill-up in gallons or litres,
The fuel to arrival in gallons or litres,
The fuel until empty in gallons or litres,
The current fuel consumption per hour in gallons or litres,
The average fuel consumption for a trip in gallons per hour or litres per hour.
The current fuel efficiency miles per gallon,
The current fuel efficiency in litres per hundred kilometres,
The average fuel efficiency for the trip in miles per gallon or litres per hundred kilometres.

Other functions it is capable of determining are by the use of sensors, outside, and inside temperature, in either Fahrenheit or Centigrade and Battery voltage. Another big plus is the computerised cruise control. It is more than a simple speed maintaining device. It establishes and maintains pre-selected road speed. You can tell the computer how fast you want to travel and it takes over. It also features a resume and traffic flow adjustment. Spectrum Marketing will be handling the Compucruise unit and their address is listed at the end of the article.

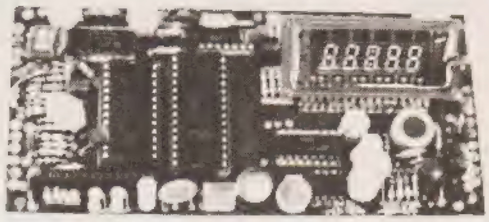
Translator Wars

Texas Instruments, as expected, introduced the first talking language translator. The language translator would retail for about $250. TI expects to ship about 100,000 units in 1979, with first shipments designated for September. The translator can produce thousands of spoken phrases by linking together its vocabulary of about 500 spoken words. Its display only vocabulary is about 1,000 words. English and Spanish modules, priced at about $50 each will be available in Spetember, the French and German modules are scheduled to follow in the fourth quarter. Japanese and Chinese will be ready in early 1980; according to TI.

Basically, it has five different features:—

CONSUMER SHOW REPORT

A giant version of the Texas Instruments translator.



The internals of the Compucruise unit.

1) Phrase — gives you instant access to the most commonly used expressions and statements.
2) Phrase Link — lets you build up over a thousand things to say with fill-in blank statements and questions.
3) Translate — gives you translations for words entered in letter by letter.
4) Learn — helps you build vocabulary in sixteen useful categories such as food, travel, medical etc.
5) Memory Learn — drills you on pronounciation and translation of words you select.

However, this winter at the Last Vegas CES show Craig and Lexicon introduced the first "Language Translator" calculators. They are back with improved models, but will have a hard time catching up with Texas Instruments entry into the field. Craig is up-grading its new M.100 language translator to the status of a personal computer with a range of new software, some offering programs on Diet, Taxes and other non-translation topics. Included are capsules on First Aid, Bar Tending, Caloric content of food, Income Tax and Word Games.

The firm is also adding several new language capsules, including double capacity units in German, French, Spanish and Italian — all with 2,400 word capacity. Cherry Leisure, whose address appears at the end of this article, are handling the Craigs' M.100 language translator.

The Windert Watch Company have taken time out of the realm of the abstract. The Company's new talking watch, new at this show, is a first to break the sound barrier with the watch and clock that literally tells time in four languages. The "voice master" is the only such product on the market, and will be ready for selected stores before Christmas. By January 1980, the solar powered multi-functioned watch, which will retail at about $100 will be available nationwide.

The watch will announce hours, minutes, and seconds and can also pronounce an alarm message. The voice is flat and uninspiring. But we were assured that the demonstration model had only 16K of ROM whilst the final version will have 64K of ROM and the voice will be much more human then. Though diction and internation should improve, the message remains the same: "Times up go, go, go" a snooze feature says "Now it is five minutes past" (the alarm time) "It is now ten minutes past" (the alarm time). The talking clock speaks four different languages: the watch can speak one of four. Both watch and clock will have LCD readout.

Once again the sheer electronic enthusiasm and paraphernalia were completely overwhelming, every aspect relating to consumer electronics. There is a general trend in High Fidelity products for example, to become much more remote control orientated this was demonstrated admirably by Sony, Hitachi and the Belgium company Barco.

Most manufacturers are rushing products through to enable them to have a hold on Christmas, the most lucrative time. Most of the show was apparently orientated around the Orient; Japanese companies really dominated the show in terms of stand space, and products available. But the American public seemed totally undaunted by this invasion and we look forward to seeing another pot-pourri of consumer electronics in January, 1980.

Spectrum Marketing,
Spectrum House,
48, Cambridge Road,
Barking, Essex.

Contact: Mike Alter.

Cherry Leisure U.K. Ltd.,
387, High Road,
Willesden,
London NW10.

Contact: Tony Varnals

READER SURVEY

Its time for good men (and women) to show us what you're made of. Or at least who you are and what you are. Computing Today is still a young magazine, and as such has a lot to learn about itself. The most important of which is how well you — our readers — think of us.

Overleaf you will find that most dreaded of pages — a form to fill in. Please don't pass on by but rather take your pen and wield it bravely in the name of a better CT! This is the chance you always wanted to tell us exactly what we should do with CT — editorally of course. Without your guidance how are we to know what you want from us?

Go on — spend a little time and ink on our behalf — improve your environment — make CT a better place to be and the world a safer place to live!

CT Survey
Modmags Ltd
145 Charing Cross Road
London WC2H 0EE

READER SURVEY

1) Please rate the following articles on a scale of 1 (awful) to 9 (brilliant). If you didn't read the feature, please score 0.

	SCORE	READ FULLY	SCANNED OVER	COMMENTS?
SCES SHOW REPORT				
TRITON BASIC				
NEWS				
COMPUTER MUSIC				
MPUs BY EXPT				
HEX CONVERTOR				
SOFTSPOT				
WORD PROCESSORS				
SPEECH RECOGNITION				
BRANDS				
CARTOONS				
BEGINNING BASIC				

Asterisk the single best feature in your estimation.

In addition please make any comments you would like to in the space provided. (Go on — don't be shy!)

ISSUE ISSUES

2) Do you consider yourself a regular reader? Yes/No
If yes — how long?

3) If you've been a reader since No.1, how does CT now compare with CT then?
Circle appropriate comment.

Much better Slightly better No different
Slightly worse Much worse Oh my God!

4) How long do you keep your past copies of CT?
1 month 3 months 6 months

5) How did you become a reader of CT?
By accident (?) Friends copy Impulse buy Advertisement
Other (please specify)

6) How many people read your copy?

PROJECTS

7) Have you ever built a project from CT? Yes/No
If yes which – please list

1.
2.
3.
4.
5.
6.

8) Do you like the idea of projects in CT? Yes/No

18) Is there anything you'd like to see appear as an offer in CT?

19) Have you every bought any goods from CT mail order? Yes/No

If yes how was the service you received?

Good Fair O.K. Poor Bad Bloody Awful

Any problems? (Please specify below)

ADVERTISING

20) Do you read the advertisements in CT?
Frequently Occasionally Never

21) Have you ordered goods as a direct result of an advertisement in CT? Yes/No

22) Have you any comments on advertisements in CT?

23) Are you employed in the computer field? Yes/No

24) If so
(a) Does your employment entail the
purchase
recommendation on the purchase
use of
computers or associated hardware?

(b) Indicate the categories with which you are concerned giving, if possible, your company's annual expenditure in each
Microcomputers . . . .

Minicomputers . . . .

Peripherals . . . .

Software . . . .

Other (please state) . . . .

25) If you own/intend to purchase a microcomputer for the purpose of home use only please state your approx total expenditure
(a) In the last 12 months . . . .

(b) Planned for the next 12 months . . . .

9) If there anything you would especially like to see as a project in CT? Yes/No
Please specify.

10) In general, if there is a kit available for a project would you purchase that rather than assembling the components yourself? Yes/No

11) Do you construct using P.C.Bs? Yes/No
If yes, do you etch your own? Yes/No

12) In general again, do projects constructed from CT work first time? Yes/No

13) Do you as part of your job use a computer Yes/No
If yes please indicate the areas which you work.
Business/Scientific/Research/Program Development/Hardwave Develop/Education/other.
Please specify . . . .

14) Do you use a computer at home, or have access to a computer through friends/club etc. Yes/No

15) If you own or have access to a computer for personal use what machine is it:
PET/TRS-S0/Apple/Nascom/Research Machines/MK 14/Acorn/Sorcerer/Horizon/Tecs/77-68/Triton/Superboard/AIM 65/Other (Please specify) . . . .

16) If you have a "homebrew" machine for personal use please indicate the CPU
Z80/8080/6800/6502/9900/other (please specify) . . . .

17) Are you using, or hope to acquire, any peripherals. Please indicate which . . .

	OWN	HOPE TO	BEG BORROW OR STEAL
PRINTER			
DISK			
MORE MEMORY			
MODEM			
SPEECH SYNTHESISER			
GRAPHICS UNIT			

READER PROFILE

These are personal questions which you may find objectionable. Please feel free to tell us to mind our business in that case. Answering them would help us greatly, however, and your co-operation would be appreciated. All info treated strictly as statistics and in confidence.

26) How old are you?

27) Sex (Male/Female/Undecided)

28) Total annual income £

.29) Do you hold any of these credit cards?
Barclaycard Access American Express

30) To what level were you in full time education?
C.S.E. 'O' Level 'A' Level
O.N.C. H.N.C. Degree

31) Does your course involve computing? Yes/No
If yes please indicate area/areas covered
Hardware/Software/Design/Systems/other (specify) . . . .

32) Do you find the computer facilities at your college useful?

33) What machine/machines are available, briefly please

34) What do you like about CT?

35) . . . . and dislike?

36) Any suggestions for improvement?

37) Do you belong to a computing club? Yes/No

38) Was you club featured in our July Club Survey? Yes/No

39) If no please give brief details eg name and number of 1° contact so we can update our list . . . .

40) On an arbitrary scale of 100 with CT scoring 50, please rate the competition against us.

	READ				
	REGULAR	OFTEN	USED TO	NEVER	RATING
RADIO CONSTRUCTOR					
WIRELESS WORLD					
TELEVISION					
VIDEO					
PRACTICAL COMPUTING					
PRACTICAL WIRELESS					
PRACTICAL ELECTRONICS					
PERSONAL COMPUTER WORLD					
BYTE					
ELEKTOR					
EVERYDAY ELECTRONICS					
COMPUTING TODAY					50
HOBBY ELECTRONICS					
E.T.I.					

On an arbitrary scale of 100 with E.T.I. scoring 50, please rate the competition against us.

Thank you for your time and patience.

TELEPHONE CHARGE CLOCK

SPECIAL OFFER

Have you any idea how much phone calls actually cost you?

You can work it out, of course, but do you ever bother? Bet you don't. The final cheque-book-splitting figure depends on the time of day, distance and how long you spend discussing the philosophical ramifications of decreased bacon sandwich availability in Colchester (or the weather).

You can save yourself a lot of calculation or guesswork by sending only £15.95 for the Monitel Telephone Charge Clock.

The unit sits underneath your telephone, plugs into any electrical socket and, when you're not using it, serves as a smart digital clock. It even comes in all the seven standard telephone colours.

It comes already programmed with Post Office charge bands. Moreover, it adjusts automatically to peak, standard and cheap rate periods *and* the charge includes VAT.

The clock takes its instructions from a punched card. When the rates change, Monitel will automatically supply a new card.

Win £50

When you get your Charge Clock, have a look at the punched card. Monitel are offering a prize of £50 for the first person to send us a punched card correctly programmed to operate a UK Monitel according to the following imaginary tariff structure:
Unit — 4.5p; Peak rate Monday-Friday 10 am-2 pm; Standard rate Monday-Friday 8 am-10 am and 2 pm-7 pm and Saturday 10 am-2 pm; Cheap rate other times.

Times	Peak	Standard	Cheap
L	30	60	90
a	20	40	60
b	10	20	30

ONLY £15.95

(Rec. retail price £19.95)

inc. vat & postage

To: Telephone Charge Clock Offer
CT Magazine
145, Charing Cross Road
London WC2H 0EE

Please find enclosed £15.95 for my Telephone Charge Clock.

Name . . . .

Address . . . .

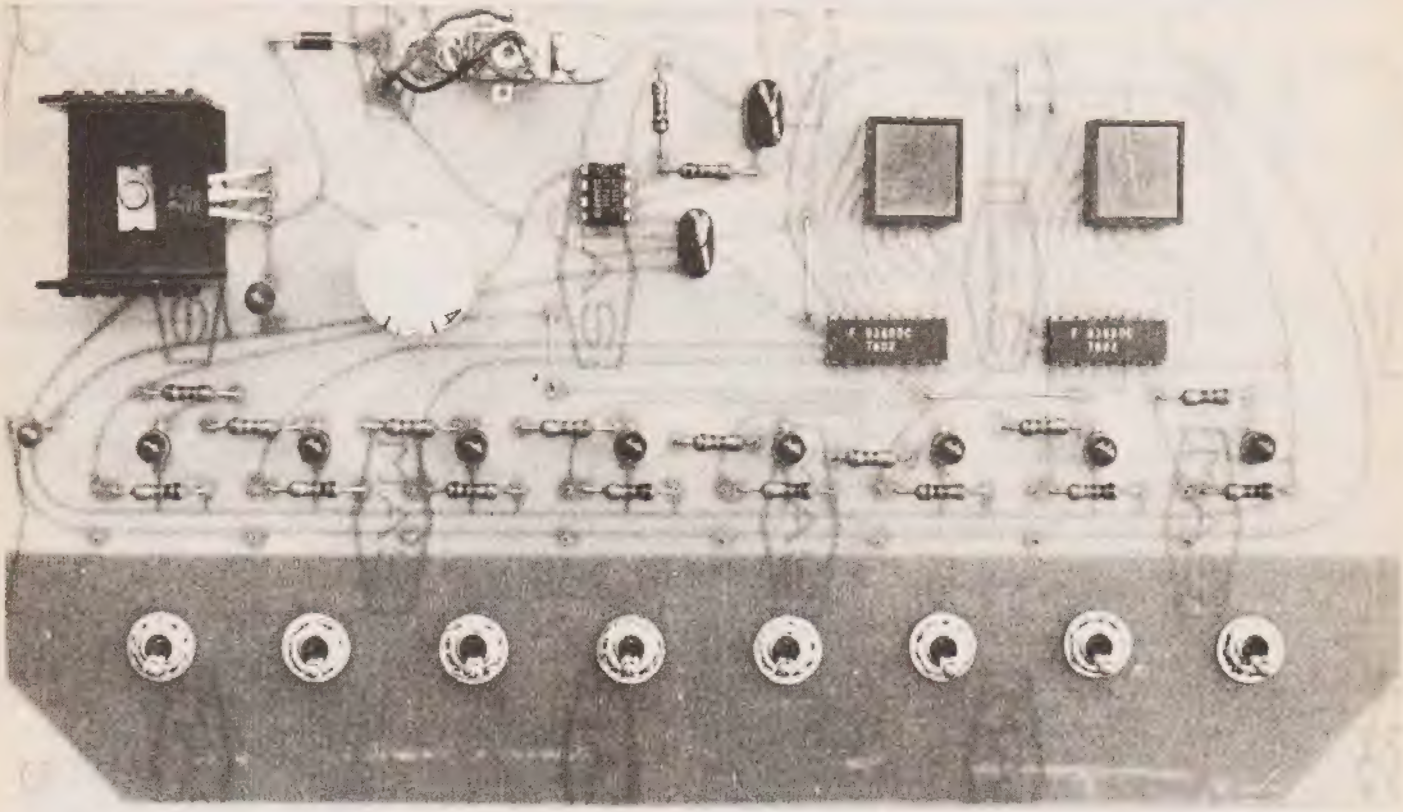
. . . .

Colour . . . .

Offer closes Sept. 31st. Please allow 14 days for delivery.

SPECIAL OFFER * SPECIAL OFFER * SPECIAL OFFER * SPECIAL OFFER * SPECIAL OFFER * SPECIAL OFFER * SPECIAL OFFER *

David Tilbrook



Are you hexed with number systems? Build this '1'

In many digital systems information is handled in groups rather than as individual bits. These groups are called words and they vary in size according to the needs of the particular job. If it is necessary to display or calculate using the normal decimal digits, a four digit binary word (four bit word) would be needed to represent each single decimal number. A four-bit binary word gives 16 possible different combinations. For a decimal number we only need ten, so the largest six combinations are ignored.

The number 0 is represented as 0000, 1 as 0001, 2 as 0010, 3 as 0011, 4 as 0100 and so on. This is called binary coded decimal or BCD and is used in many digital applications such as digital frequency meters, digital multi-meters, calculators, etc.

As the job required of the digital system becomes more complicated, word lengths are increased. This gives the circuit the ability to handle more complex numbers by manipulating single words. The most common word length in microprocessors is eight bits. The eight bit word is called a byte and contains 256 different combinations. In the bigger microprocessor and smaller computers a word length of 16 is used, while full-scale computers use word lengths of 32 or even 64 bits! This is all very fine for computers, but for mere mortals like ourselves calculating with 64 digit numbers can become a little tiring!

This project was designed to assist the newcomer in getting used to the hexadecimal and binary number systems. It can also be used by those working out opcode (micro-processor instructions) from binary numbers.

Some mini-computers and microprocessors, such as the 2650, have their instructions written in the form of binary numbers, with some of the digits missing. Depending upon the particular variation of the instructions required, the missing 0s and 1s are filled in. When the total binary word has been formed it must be converted into hexadecimal form for keying into the microprocessor. A realtively large program for a microprocessor might have one or two thousand opcodes to be evaluated — this is one application where the binary to hex converter could be put to good use.

Construction

The entire trainer is made on a single printed circuit board and construction is fairly non-critical.

Start by mounting the resistors on the PCB. Next, mount the capacitors, with the exception of the big 470 uF electrolytic. Be sure to orientate the tantalum capacitors correctly. If they are not marked with a +ve symbol they will probably be the type marked with coloured bands and a dot. With the dot facing towards you and the leads pointing down the positive lead is usually the one on the right. The IC's and displays should be soldered onto the board using reasonable care not to overheat the pins. Make sure they are orientated correctly also. If they are installed incorrectly and the board is powered up, they will probably be destroyed. The pads for the IC's are realtively close together and care should be taken to avoid bridging solder to adjacent pads.

The LED's and diodes can be fitted next and once again make sure these are put in the right way around.

The voltage regulator IC should be mounted onto a heatsink and secured to the PCB by a single nut and bolt. Insulation between the regulator and heatsink is not needed but some type of thermal paste compound should be used.

Mount the regulator first and then solder its leads onto the board, this avoids straining these solder joints. Fit the remaining electrolytics and wire links. Often cut-off resistor leads can be used for these links. All that remains is to fit and wire the switches and power sockets. The board requires an external DC supply, the regulator makes sure the IC's get the correct voltage. The DC supplied to the board should be greater than about seven volts.

HEX CONVERTER

As this voltage increases, the regulator dissipates much of the excess power in the form of heat and this is why the heatsink is necessary. On 12 V the regulator on the prototype gets quite hot, but not excessively. The board requires 450 mA worst case, so some of the bigger battery eliminators should do the job well. The socket for the power input can be a bit tricky to work out. The centre point on the socket is usually negative. Solder a wire from the centre terminal to the negative pad on the PCB. This is the pad not connected to the diode. The positive terminal on the socket is the terminal connected to the outside of the plug. This should be connected to the PCB pad that connects to the diode. If in doubt, connect the battery eliminator into the socket and check with a multimeter.

Almost any type of toggle switch will work in this project. Find a set of contacts that are open when the switch is in the up position, and wire these to the PCB pads as shown in the diagram.

Using It

Before applying power to the board check the capacitors, LEDs and IC orientations. When the board has been completely checked it can be tried out. Place all the switches in the up position and apply power. Immediately the seven segment displays should show '00'. As the toggle switches are changed the LEDs will light and the displays should change to indicate the correct hexadecimal number corresponding to the binary number shown on the LEDs.

HOW IT WORKS

The heart of the circuit consists of the two 9638 ICs. These are BCD to hexadecimal seven segment decoder-drivers. On receipt of a low on the clock input-pin 3, they load the binary word present on their inputs into latches, decode them into hexadecimal numbers and drive the appropriate segments in the FND500 displays. The binary number is reloaded into the input latches each time the clock input is taken low.

The 555 timer IC is operating as an astable multi-vibrator and generates a pulse used to trigger the clock input. The repetition rate is around 5 kHz, determined by the two 1k resistors connected to pin 7 and the 0.1 uF capacitor connected to pin 5 of the timer.

The inputs of the 9368's are connected via 1k pull-down resistors to zero volts to ensure the inputs stay low when the toggle switches are in the open position. When the binary number is selected, by closing the appropriate toggle switches, these input lines are taken high.

LED's are used to display the binary number and are connected to the toggle switches via 220R current limiting resistors.

A 7805 voltage regulator IC has been included on the board to allow the circuit to be run from a variety of DC supply voltages.

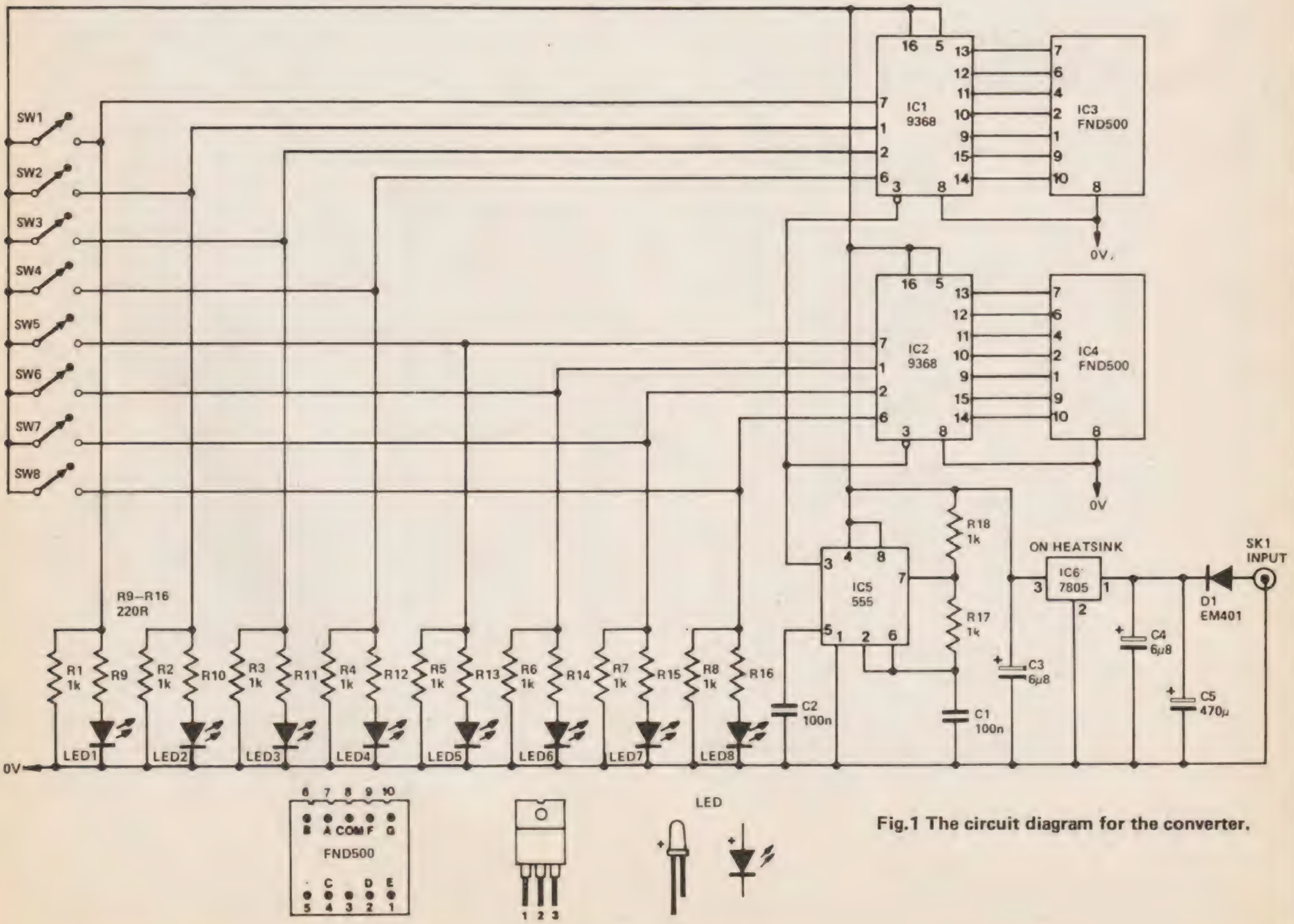
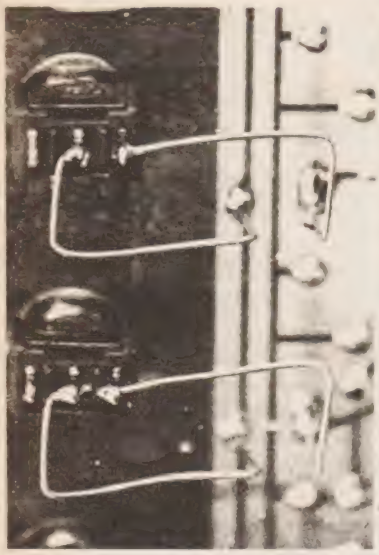


Fig.1 The circuit diagram for the converter.



The photo shows the switch wiring method used.

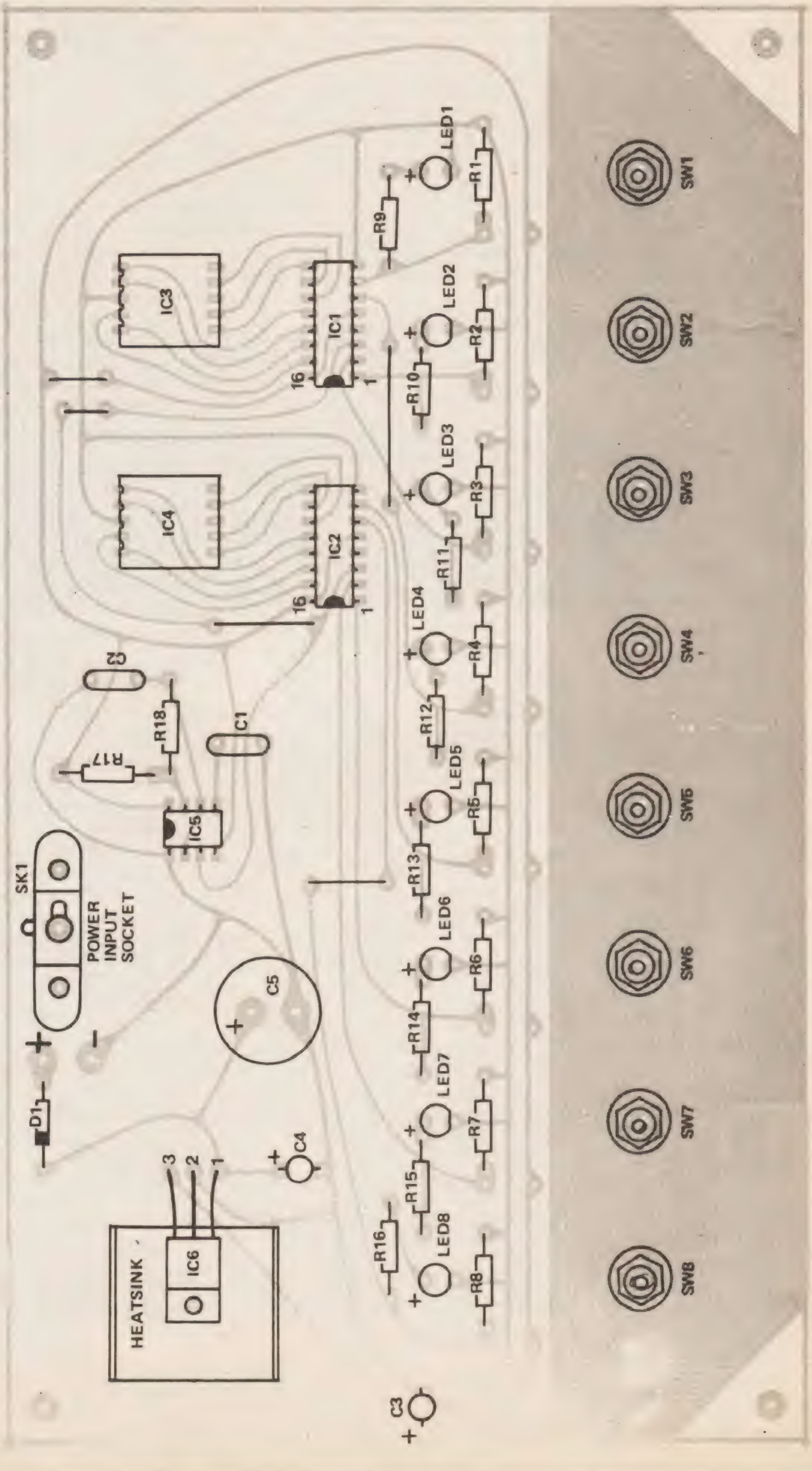
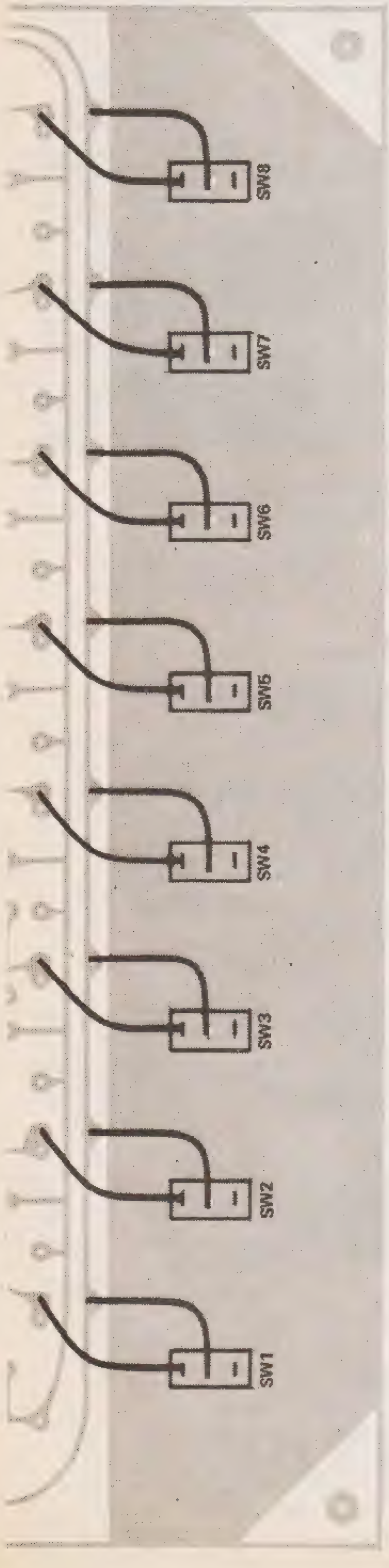


Fig.2 Component overlay. See Fig.3 for switch connection details.



The Hexadecimal Number System

We've already mentioned that a four bit binary word had sixteen different combinations. If we defined sixteen characters and let them be equal to these sixteen combinations we would write any four bit binary word using a single character.

This is the basis of the hexadecimal number system. The first ten digits are the same as in BCD, i.e: the normal decimal numbers. The six extra combinations not used in the BCD system are given the characters A, B, C, D, E and F. The number sequence would therefore be 1, 2, 3, 4, 5, 6, 7, 8, 9, a, b, c, d, e, f and would then continue 10, 11,. . . 18, 19, 1A, 1B, 1C, 1D, 1E, 1F, 20,. . .and so on.

A byte can be written as a two digit hex (hexadecimal) number, which is considerably shorter and more convenient. Nevertheless the relationship between binary and hexadecimal is not obvious at first and converting from binary to hex can become a tedious business, especially if the binary numbers are getting rather large.

Fig.3 Switch wiring. Note that the wires are soldered onto the PC pads provided for this purpose.

Owing to the size of the PCB being bigger than that of the page we are unable to print it in this issue. Foil patterns are available from our offices, please send an SAE to us marked "FOIL PATTERNS" for your copy.

PARTS LIST

Resistors
R1-R8,17, 18 1k0
R9-R16 220R

Capacitors
C1, 2 100n polyester
C3, 4 6u8 16V tantalum
C5 470u 25V electrolytic

Semiconductors
IC1, 2 9368
IC3, 4 FND500
IC5 555
IC6 7805

D1 EM401 or equivalent

LED1-LED8 red LEDs (TIL 209)

Miscellaneous
SW1-SW8 SPST toggle
SK1 9V power socket

BUYLINES

The IC's and seven segment displays used in the project should be generally available but we understand that Technomatic have supplies if you encounter any difficulties. They are at 17 Burley Road, London NW10 1ED.

Apple II Plus

APP_E-II PLUS will change the way you think about computers. That's because it is specifically designed to handle the day to day activities of education, business, financial planning, scientific calculation, and entertainment. APPLE-II PLUS is appealing and comfortable (like other appliances that make your life easier), and it brings to personal computing a new level of power through hardware and software sophistication.

The APPLE-II PLUS is faster, smaller and more powerful than its predecessors, and it's easier to use too, because of advanced, built in features like:

***PALSOFT**
A fast, extended 10K BASIC with 9-digit precision and graphics extensions.

***HIGH RESOLUTION GRAPHICS**
On a matrix of 280X192 individually addressable points.

***AUTO-START ROM**
With power on boot of application programs, reset protection and improved screen editing.

***INTERNAL MEMORY EXPANSION TO 64K BYTES**
For big system performance at a low cost.

***EIGHT EXPANSION SLOTS**
To let the system grow with your needs.

Apple Pascal

APPLE PASCALTM is the new extension to microcomputer power.

PASCALTM incorporating UCSD PASCALTM, offers extended features in a complete interactive package employing today's most sophisticated structured programming language. It provides advanced capabilities that boost performance and cut development time for large business, scientific, and educational programs.

This software package provides the most powerful set of tools yet available for the microcomputer programmer.

***EDITOR**
A fast, screen-oriented editor for program development and word processing applications.

***COMPILER**
Standard PASCAL plus full set of extensions for strings, disc files, graphics and system programming. Hi-res graphics "Turtlegraphics": as originated at MIT INIT turtle, PENCOLOR, TURNTO, TURN, MOVE, TEXT GRAF.
GOTOXY procedure for cursor addressing.
FUNCTION Keypress tells whether character available.
Library routines include: RANDOM, RANDOMIZE, PADDLE, BUTTON, TTLOUT, KEYPRESS etc.

***RELOCATABLE ASSEMBLER**
Permits relocatable assembly language routines to be generated and linked to Pascal programs.

***SYSTEM UTILITIES**
Includes desk calculator-performs basic calculations and parameter — allows examination and modification of system environment.

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Gives your system immediate access to large quantities of data. The subsystem consists of an intelligent interface card, a powerful Disk Operating System and one or two mini-floppy drives.

Features

- Storage capacity of 116 kilobytes/diskette.
- Date transfer rate 156K Bits/second.
- Individual file write protection.
- Powered directly from Apple II.
- Full disk capability with systems as little as 16K bytes of RAM.
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- Powerful disk operating software.
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Allows you to connect almost any popular printer to your Apple. A BASIC program can produce hard-copy output as easily as it prints to the TV monitor screen. Command interpretation and printer control details are handled by the firmware built into the card, to eliminate user programming requirements.

Nett	Vat	Total
110 00	16.50	126.50

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Allows your Apple to "talk" (though a modem) with other computers and terminals over ordinary telephone an load programs over the phone, send messages to remote terminals or access your office computer from the comfort of your home.

Communication Interface Card

Nett	Vat	Total
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Allows Apple to exchange data with printers, plotters and computers in serial format at up to 19.2 K Baud.

High Speed Serial Interface Card

Nett	Vat	Total
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Voice Recognition Card

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Prototyping Card

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Carrying Case

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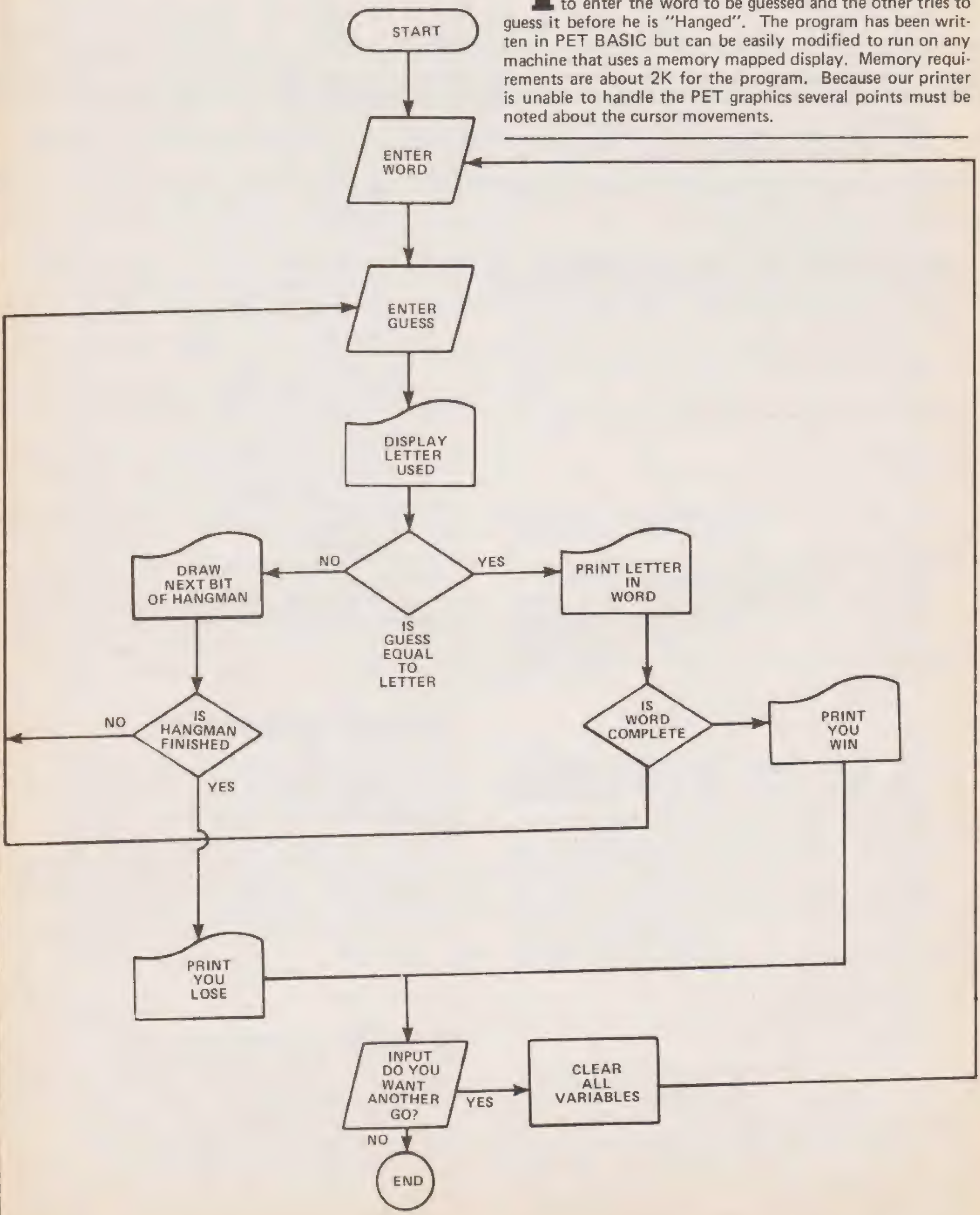
BARCLAYCARD VISA

M.J. Coates

Fig 1. The flowchart for the Hangman game.



In its present format this program will play the game of Hangman with two people. One person is required to enter the word to be guessed and the other tries to guess it before he is "Hanged". The program has been written in PET BASIC but can be easily modified to run on any machine that uses a memory mapped display. Memory requirements are about 2K for the program. Because our printer is unable to handle the PET graphics several points must be noted about the cursor movements.

Line 100: The '3' is the CLR character.
Line 180: Insert HOME, 12 DOWN.
Line 220: Insert HOME, 5 DOWN.
Line 270: Insert HOME, 2 DOWN, 1 RIGHT.
Line 310: Insert HOME, 2 DOWN, 3 RIGHT.
Line 350: Insert HOME, 2 DOWN, 5 RIGHT.
Line 390: Insert HOME, 2 DOWN, 7 RIGHT.
Line 430: Insert HOME, 2 DOWN, 9 RIGHT.
Line 470: Insert HOME, 2 DOWN, 11 RIGHT.
Line 890: Insert HOME, 2 DOWN, 1 RIGHT.
Line 990: Insert HOME, 16 DOWN.

Room has been left at the start of the program, i.e. before Line 100 for the user to add in a random choice of words so that only one person plays the game at a time.

Fig 2. The program listing for the BASIC game of Hangman.

```
100 PRINT"3ENTER A SIX LETTER WORD IN FORMAT"
110 PRINT"LETTER 1,2,3,4,5,6
120 INPUT A$,B$,C$,D$,E$,F$
130 Q=0
140 PRINT"3I HAVE A SIX LETTER WORD"
150 PRINT
160 PRINT
170 PRINT" # # # # # # "
180 PRINT"%A B C D E F G H I J K L M"
190 PRINT
200 PRINT"N O P Q R S T U V W X Y Z"
210 G=0:V=0
220 PRINT"%WHAT IS YOUR LETTER"
230 INPUT Y$
240 IF Y$=A$ THEN260
250 GOTO280
260 V=V+1
270 PRINT" ";A$
280 IF Y$=B$ THEN300
290 GOTO320
300 V=V+1
310 PRINT"    ";B$
320 IF Y$=C$ THEN340
330 GOTO360
340 V=V+1
350 PRINT"      ";C$
360 IF Y$=D$ THEN380
370 GOTO400
380 V=V+1
390 PRINT"        ";D$
400 IF Y$=E$ THEN420
410 GOTO440
420 V=V+1
430 PRINT"          ";E$
440 IF Y$=F$ THEN460
450 GOTO480
460 V=V+1
470 PRINT"%            ";F$
480 IF Y$="A" THEN M=0
490 IF Y$="B" THEN M=2
500 IF Y$="C" THEN M=4
510 IF Y$="D" THEN M=6
520 IF Y$="E" THEN M=8
530 IF Y$="F" THEN M=10
540 IF Y$="G" THEN M=12
550 IF Y$="H" THEN M=14
560 IF Y$="I" THEN M=16
570 IF Y$="J" THEN M=18
580 IF Y$="K" THEN M=20
590 IF Y$="L" THEN M=22
600 IF Y$="M" THEN M=24
610 IF Y$="N" THEN M=80
620 IF Y$="O" THEN M=82
630 IF Y$="P" THEN M=84
640 IF Y$="Q" THEN M=86
650 IF Y$="R" THEN M=88
660 IF Y$="S" THEN M=90
670 IF Y$="T" THEN M=92
680 IF Y$="U" THEN M=94
690 IF Y$="V" THEN M=96
700 IF Y$="W" THEN M=98
710 IF Y$="X" THEN M=100
720 IF Y$="Y" THEN M=102
730 IF Y$="Z" THEN M=104
740 POKE(33248+M),32
750 IF V>G THEN940
760 V=G
770 Q=Q+1
780 IF Q=1 THEN POKE33172,100:POKE33173,100
790 IF Q=2 THEN POKE33173,76:POKE33133,101
800 IF Q=3 THEN POKE33093,101:POKE33053,101
810 IF Q=4 THEN POKE33053,79:POKE33054,99
820 IF Q=5 THEN POKE33055,80
830 IF Q=6 THEN POKE33095,118:POKE33096,117
840 IF Q=7 THEN POKE33135,78
850 IF Q=8 THEN POKE33136,77
860 IF Q=9 THEN POKE33175,78
870 IF Q=10 THEN POKE33176,77:GOTO890
880 GOTO220
890 PRINT" ";A$;" ";B$;" ";C$;" ";D$;" ";E$;" ";F$
900 POKE33099,25:POKE33100,15:POKE33101,21:POKE33102,39:
    POKE33103,18
910 POKE33104,5
920 POKE33106,4:POKE33107,5:POKE33108,1:POKE33109,4
930 GOTO990
940 IF V=6 THEN970
950 G=V
960 GOTO220
970 POKE33099,25:POKE33100,15:POKE33101,21
980 POKE33103,23:POKE33104,9 :POKE33105,14
990 PRINT"%%DO YOU WANT TO PLAY AGAIN?"
1000 GET J$:IF J$="" THEN1000
1010 IF J$="Y" THEN1030
1020 END
1030 CLR
1040 GOTO100
```

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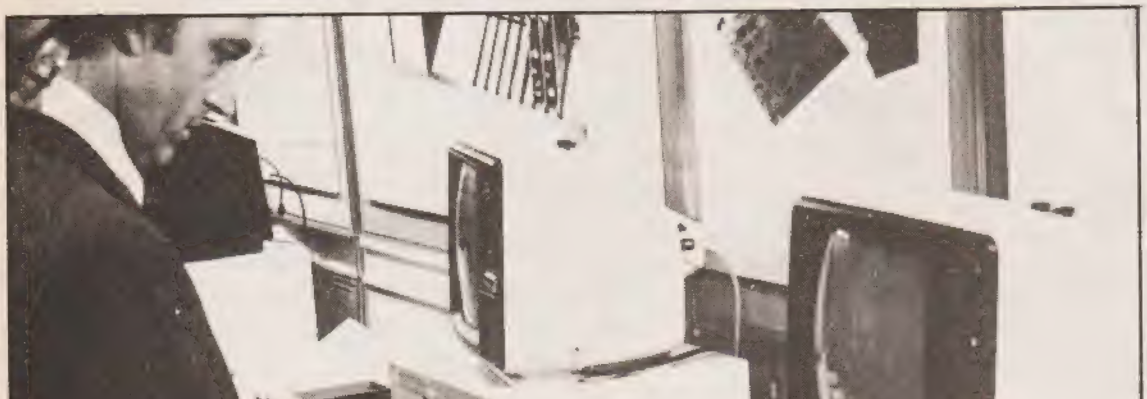
A pictorial view of the 1979 Microcomputer show held last month in London



Top to bottom: A view of the crowded and overheated hall. The TECS system in its various formats, PO approval has been given for Prestel, see News. Another Nascom system, with thoughtful viewer.

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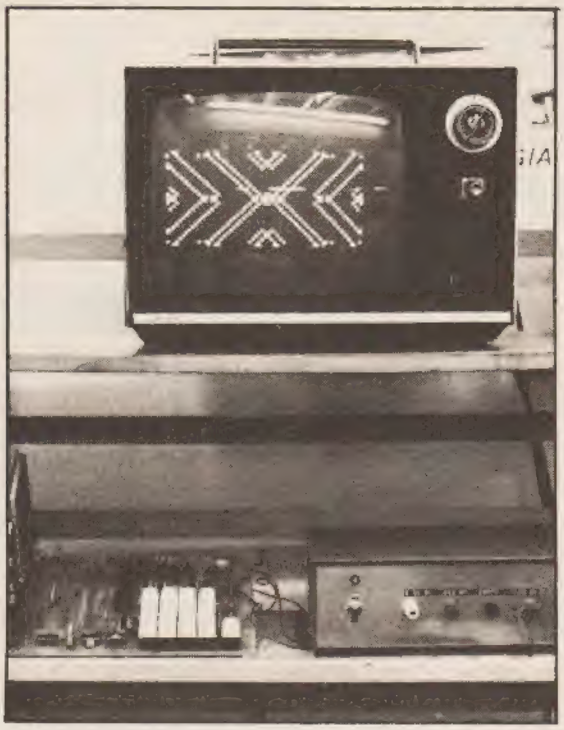
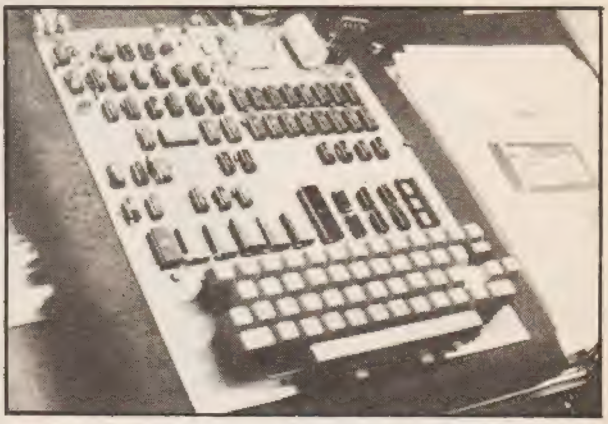
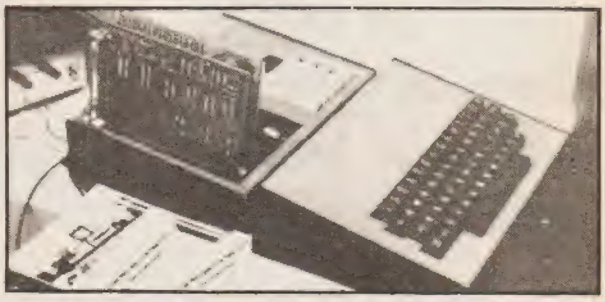


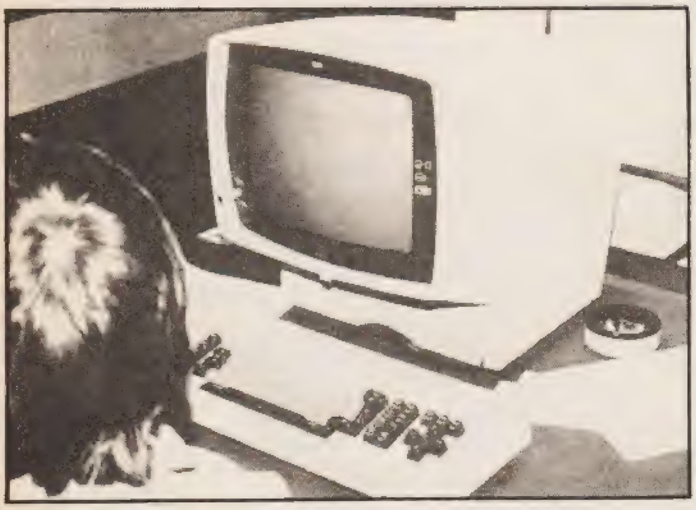




Right: An ELF II displaying its graphics potential. Not quite what you might think, this is the UK 101. Another ELF, this time with case and full ASCII keyboard see our review next month.

Above and left: A DEC intelligent terminal running on a Plessey systems sixteen bit machine. Intense concentration on the face of a young Nascom user.

Word Processing is the talk of the town; we reveal the state of the art

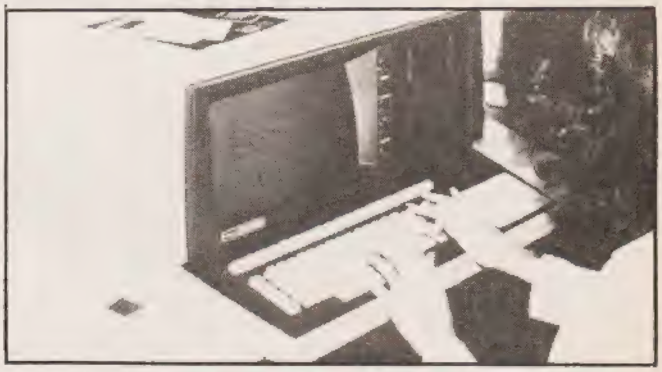


Above, left and right are two of IBM's wordprocessor stations. Below is a section of the futuristic lower hall used for the show.

Another view of the lower hall at Wembley. The "greehouse" belonged to Dictaphone.

A Logica VTS word processor terminal.

One of Wang's terminals, their seminar presentation raised more than a few chuckles.



A Data Logic VT1303 WP station being demonstrated.

Phil Cornes.

Extend your BASIC with our series

We will start off this month by looking at last month's homework, which may have increased the aspirin intake of some of you. The problem required that you write a program which will ask for the name of a month to be input, accept an answer as a string and then search through the input string for the occurence of the letter R.

Searching Strings

If an R is found, the program should say that YOU CAN EAT PORK IN your input month. If no R is found, the opposite message shall be output. The problem in effect boils down to checking through an input string to find a particular character. If the character is present, an output to this effect is given; otherwise the opposite output is printed.

Consider the following:–

```
40 PRINT "INPUT MONTH"
50 INPUT M$
130 L=LEN(M$)
140 FOR N=1TO L
150 Q$ = MID $ (M$,N,1)
160 IF Q$ = "R" THEN 200
170 NEXT N
180 PRINT "YOU CANNOT EAT PORT IN";M$
190 END
200 PRINT "YOU CAN EAT PORK IN";M$
210 END
```

Here you are asked to input the name of a month (lines 40 and 50) then a check is made to find the length of the input string (M$) (line 130) which is assigned to variable L.

We now need to make a check character by character to test for the chosen character (R here). To do this we set up a FOR NEXT loop in N between 1 and L. We then extract the Nth character of M$ (line 150) and assign this to Q$. This character is then checked to see if it is an R. If it is, we branch to line 200 and PRINT:–

"YOU CAN EAT PORK IN";M$

If the character is not an R we branch back to check the next character of M$ (line 170).

At first sight this program appears to work quite well, but if we look at the test data specified last month then we run up against a problem. The test data was:–

1) MAY
2) OCTOBER
3) MARCH
4) ENGLAND

If these were entered we would get the following as output:

1) YOU CANNOT EAT PORK IN MAY
2) YOU CAN EAT PORK IN OCTOBER
3) YOU CAN EAT PORK IN MARCH
4) YOU CANNOT EAT PORK IN ENGLAND

Using DATA Strings

The problem as set last month doesn't require the computer to pass judgement upon the location, but upon the month. Unfortunately, we have not given the computer any method of "knowing" whether the input string is a month or any other word, the computer just treats it as a string. If we want only months to be dealt with, then we have to tell the computer how to check this out.

One solution is to give the computer a list of the 12 acceptable inputs in a DATA statement and then check the input M$ against each of these to seek a match before going on to the rest of the program. This is done in the program below by lines 60–120 and 300–320. Apart from these additions, the program is the same as the previous one.

```
40 PRINT "INPUT MONTH"
50 INPUT M$
60 RESTORE
70 FOR C=1 TO 12
80 READ T$
90 IF T$=M$ THEN 130
100 NEXT C
110 PRINT M$;"IS NOT A MONTH NAME"
120 END
130 L=LEN(M$)
140 FOR N=1 TO L
150 Q$=MID$(M$,N,1)
160 IF Q$="R" THEN 200
170 NEXT N
180 PRINT"YOU CANNOT EAT PORK IN";M$
190 END
200 PRINT"YOU CAN EAT PORK IN";M$
210 END
300 DATA JANUARY, FEBRUARY, MARCH,
    APRIL
310 DATA MAY, JUNE, JULY, AUGUST,
    SEPTEMBER
320 DATA OCTOBER, NOVEMBER, DECEMBER
```

I leave you to make it work. Carrying on from last month, we will now go on to look at some more string functions.

LEFT $(STRING,L)

LEFT $ is similar to MID$ in that it allows you to extract a substring from the string specified in the brackets, but here the substring will consist of the first L characters of STRING eg.

```
10 A$="TIMOTHY"
20 B$=LEFT$(A$,3)
30 PRINT B$
```

The output from this program segment would be TIM which is a substring (first 3 characters here) of the string TIMOTHY.

RIGHT $ (STRING,L)

This function works the same as the previous one except that it extracts the last L characters from the string in the brackets, eg.

```
10 B$=RIGHT$("BULLOCK",4)
20 PRINT B$
```

Here the output would be LOCK.

STR$(X)
This function converts the numeric value of the contents of the brackets into a string, eg.

```
10 A=126
20 A$=STR$(A + 12)
30 PRINT A$
```

Here the PRINT statement would output a value of 138 for A$. (This should not be confused with a value 138 assigned to a numeric variable — the 1, 3 and 8 in A$ are treated purely as characters.)

The contents of the brackets in a STR$ statement can be any constant, variable or numeric expression.

VAL (STRING)
This function has the opposite effect to the previous function. It converts a string with a numeric value back into numbers which can be assigned to a numeric variable, eg.

```
10 A$="13"
20 B$="15"
30 C=VAL(A$+"."+B$)
40 PRINT C
```

Here the value of C printed will be 13.15 because the + sign in a string expression does not mean add in the normal arithmetic sense, it means that the various strings should be lined up after each other in the order given (this is called concatanation). Similarly, we could have added a line 25 to the above segment as follows :

```
25 C$=A$+"."+B$
```

This would have been quite acceptable and C$ would have taken the value of 13.15 but this time it would have been a string and not a number.

CHR$(X)
This function returns the single character string which has X as its ASCII code. The value of X in this function is in decimal and has a range 0-127 (as there are 128 ASCII codes). The variable X in the brackets may be replaced by any constant, variable or numeric expression. For example,

```
10 FOR X = 65 TO 90
20 PRINT CHR$(X);
30 NEXT X
```

This would print out all the letters of the alphabet in order from A to Z as the numbers 65-90 are the decimal equivalents of the ASCII codes for these letters. Similarly, the numbers 0-9 have codes 48-57 as the decimal equivalents of the ASCII codes.

ASC(STRING)
This has the opposite effect of CHR$ in that it takes the first character (first character only) of the string in the brackets and returns the decimal equivalent of its ASCII code as a number to be assigned to a numeric variable. Eg,

```
10 A$="STRING"
20 A=ASC(A$)
30 PRINT A
```

Here A takes the value 83, which will be printed by line 30, as this is the decimal equivalent of the ASCII code for the letter S.

That completes a rather impressive list of string functions. There are one or two others which can be found on some machines, but they are not really standard and will not be introduced.

Numeric Functions
We will now go on to examine the other big plus of Extended Basic — Extra numeric functions. In all the examples below, the contents of the brackets can be replaced with either a constant, variable or numeric expression.

We have already covered 4 functions in Tiny Basic; these were ABS(X), INT(X), TAB(X) and RND(X). These four functions are still available and join the rest of the list presented below.

LOG(X)
This function returns the log to base e of the contents of the brackets, eg:—

```
10 A=LOG(3)
```

here A takes the value 1.09861.

EXP(X)
This function raises the base e to the power X and is thus the inverse of the LOG(X) function.

```
10 A=EXP(3)
```

here A takes the value 20.0855

SGN(X)
This is the Signum function. If the contents of the brackets have a –ve sign then this function returns a value –1; if the contents are +ve the function returns +1; and if the contents are zero, the function returns zero.

```
10 A=SGN(–12)
```

here A takes the value –1.

SQR(X)
This function returns a value equal to the square root of the contents of the brackets (obviously these contents must not be negative).

```
10 A=SQR(9)
```

here A takes the value 3.

TAN(X)
This function returns the trigonometric Tangent of the contents of the brackets (most trig functions assume X to be in radians — 1 degree = 0.01745 radians and 1 radian = 57.2957 degrees).

SIN(X) AND COS(X)
These functions return the trig Sine and Cosine respectively (again X assumed to be in radians).

ATN(X)
This function returns the Arctan (the angle in radians whose Tangent is X) of the contents of the brackets.

This ends the arithmetic functions: in addition most machines have two special functions, PEEK (X) and POKE L,C.

PEEK(X)
This function returns a decimal integer in the range 0-255 corresponding to the decimal value of the binary code contained in the computer memory location X. X is also in decimal and can be any constant variable or numeric expression.

POKE L,C
This function is the inverse of the PEEK function. It allows you to enter any 8 bit binary combination into any location of RAM where L is the location number and C is the code to be entered (both L and C are in decimal.)

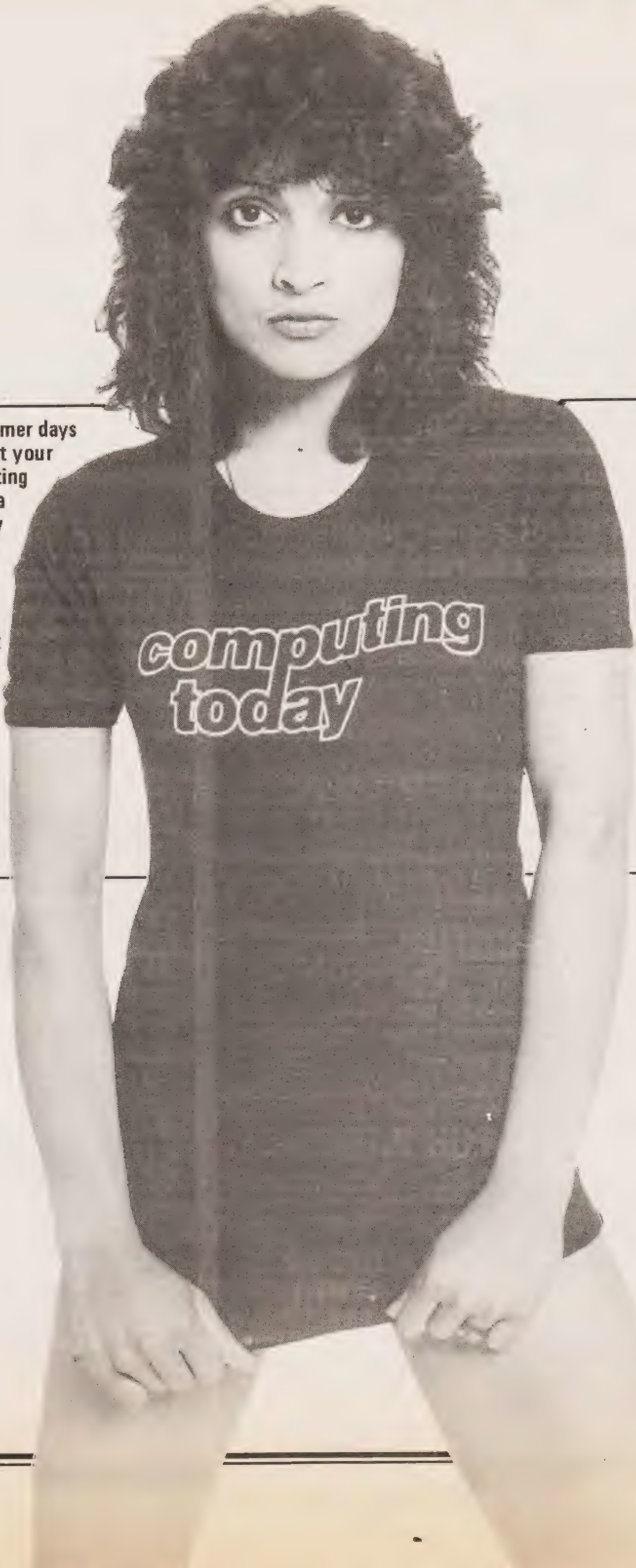
This is as far as we want to go this month, because there has been quite a lot of new material introduced and you would be well advised to re-read it if you are not familiar with it.

Homework For The Month
There are two good exercises for this month:—

1. Write a short program which will accept a number from 0-255 as input and convert this into a two digit Hexadecimal number in the range 00-FF.

2. Write a short program which will do the reverse of the above — accept a 2-digit Hexadecimal number and convert it to decimal.

And for all you bright boys (or those who don't know about Hexadecimal) you might also like to look at the problem of how you would go about taking a list of numbers in random order and sorting them into numerical order as we shall be moving on to such things from next month.


computing
today

Dear Sir,

Re my letter in your May edition. Now let's get this right, I was not complaining about the Nascom 1 but was trying to warn beginners of the fact that even if they did everything correctly there was still a large probability that the machine would not work. A project as complicated as a Nascom 1 is asking for gremlins (I had many) and you should expect to do some fault finding, hence I will say it again – the novice should seriously consider buying a working model.

The PCB for the Nascom 1 is superb, but the tracks tend to be a little too close in places (and from my experience, letters from Nasfans and personal contacts a common fault seems to be shorting between tracks due to incomplete etching).

I would have no hesitation in recommending a Nascom 1 kit to experienced constructors, or to the beginner who can get in touch with somebody who already owns a working machine. I have no ill feelings about buying my Nascom 1 and after expansion I would'nt swop it for a Pet nor a TRS-80.

Yours faithfully,
A.R.Ingleson,
B.Tech.

27 Cecil Avenue,
Great Horton,
Bradford,
W.Yorkshire BD7 3BW.

Dear Sir,

Having read the article in your June issue on the S100 bus you seem unaware that an attempt is being made to define a standard for it, in fact some products now being advertised in US magazines do state "to proposed IEEE standard".

I don't know what state things have reached in its establishment, but an article appeared in the May 1979 edition of the IEEE Journal "Computer", should anyone care to follow it up.

Yours faithfully,
David Parkinson.

Well Cottage,
The Street,
Tuddenham,
Ipswich, IP6 9BT.

Dear Sir,

Whilst I very much enjoyed the fission chips wrapped in the last issue, I did not like the silicone they were fried in.

Yours faithfully,
P.Childs.

60 Lansdowne Hill,
London SE27.

Dear Sir,

Let me first congratulate you on the contents of your magazine, which seems to have the correct balance between reviews and software. This is only slightly spoilt by typographical and programming errors. Talking of which here are a few from your Minefield game by P. Wickett.

Line 9 POKE FF,87:POKE JJ,87
Line 40 IF TIME$ > "000100" THEN 200
Line 51 IF C$ = "1" THEN 520
Lines 1030 to 1044 Ys should be Y$
Lines 624, 625, 626 & 628 could be condensed to
624 IF PEEK(FF) = 87 THEN 16. 626 IF PEEK(JJ) = 87 THEN 16.

There were no clear screen instructions in the program to remove Text from the playing field, and the game seemed difficult for beginners to win so the minimum number of mines per move was reduced to 1 thus:

Line 0 inserted PRINT "@"
Line 3 changed to PRINT"SET NO. OF MINES PER MOVE (1-30)"
Line 6 changed to PRINT "@"

The @ Reverse field Heart character is produced when the clear screen (SHIFT and HOME KEYS) command is given inside the inverted commas of a print statement.

When these changes are made the game is very absorbing and will wile away mnay an hour.

Yours sincerely,
Steve Randall.

53 Moresby Avenue,
Surbiton,
Surrey KT5 9DT.

Dear Sir,

I should like to say how much we look forward to receiving the Nascom Package Puzzle each month! June's Education Package is now doing good service in the lunch hour, although Lollipop lady and Mastermind are still in strong demand. For those who have not yet discovered this months deliberate (?) missprints they are:

```
C65  FE   25
C67  20   F5
C74  CD   B8  0D
C7C  CD   B8  0D
DB2  23
```

The DAA between lines DBF and DC1 is the subroutine title NOT an address.

Might I suggest that if you include an object code listing as well as the source code listing then it should be easier to spot missprints.

Do all your readers, particularly those very new to their Nascoms, realise that the text has to be keyed in as ASC II codes? It might help if you gave these!!!

I have just received my July Computing Today and from the first five lines of the Nascom Package it looks as if we are in for more fun this month as well.

Yours,
Alec Wood.
Physics Dept.

Wirral Grammar School for Boys,
Wirral,
Merseyside.

Dear Sirs,

As I bought a Compucolor II last March, I was interested to read the review in your June issue (which only recently reached me as I had moved countries).

I was particularly impressed by the glowing account of the 150 page manual since my machine was delivered without one and, a considerable number of transatlantic telephone calls having failed to extract one from the suppliers of the computer, I had to devote about a month of experimentation to writing my own. Thus, though the machine has many capabilities I have yet to fathom, I can state from experience that this computer represents very good value for anyone wanting both disk and colour graphics capability.

It has a good point and a bad point that your review did not mention. The good point is that almost all Basic keywords can be entered with a single key-stroke. Press "control/shift V", for example, and the key-word "PRINT" is entered into the program. This is much quicker than spelling it out manually and avoids the risk of spelling errors. One learns the correct key strokes for the commoner key-words very quickly.

Now for the bad point, the disk drive. For a start this is a stripped down version of the Wangco drive, at least on my machine which has not got the capability to format blank disks. This means you must use preformatted Compucolor disks. Further, this must be almost the slowest, lowest capacity disk drive still on sale. 40 tracks it has, but each track holds ten sectors of only 128 bytes and, as far as I can detect, only one sector is read during each turn of the disk, giving a mean data transfer rate of only 640 bytes per second, much faster than a cassette, but slow by present day disk standards.

Since the Compucolor II seems likely to be a rare beast in the U.K. in the near future, some mutual assistance among users would seem to be in order and I would be prepared to act as a centre in the setting up of a Compucolor users group.

Yours faithfully,
Tom Napier.

217 Clement Rise,
Livingston EH54 6LR.

Dear Sir,

I would be very grateful if an announcement could be published in the next 'Computing Today' to let people know that I do NOT run an Amateur Computing Group, and never have!

This must be due to a misunderstanding arising from a letter to Mike Lord some time last year.

I would also like the error to be corrected at source, so please tell the people from who you get the information of the error.

Thank you in anticipation of your help in lessening the chance of further shocks due to seeing my name in print where not expected!

Yours sincerely,
Nicolas Beard.

Newsagents,
High Street,
Braithwell,
Rotherham,
S.Yorks.

SPEECH RECOGNITION

Henry Budgett

The author and Brian Pay of NPL checking out CT.

Talking to computers; fact or fiction? Hear the word!

It is more than probable that "speech" communication between humans started before the era of cave paintings, unfortunately they did not have tape recorders so the actual dates are no more than an approximation. The word speech is used loosely at this time to mean sounds produced by one individual and understood by another, formal languages must have taken a very long time to evolve. An approximate date for early cave paintings is around 35,000 years ago, so we have some idea of the length of time it has taken for true speech communication to evolve.

Fictitious Beginnings

Because man uses speech for natural communication in preference to all else the science fiction writers simply had men talk to their invention and it understood.

The great divide in speech recognition as it stands today, is can we recognise continuous (conversational) speech rather than single words? On a limited basis the answer is Yes. The days of HAL (2001) are not yet here, but the first barriers have been breached.

Government Research

The National Physical Laboratory at Teddington contains, among other things, a Speech Recognition group headed by Brian Pay. They began investigating the problems of speech recognition in 1967 and after doing a considerable amount of both psychological and physiological research they produced a machine which could distinguish between certain vowel sounds, for example "AA", "EE", "OO" and "OR". This system was designed in hardware and used no computing power at all. By 1972 a system had been produced which used a computer to collate the data and this was given the generic name of SID, Speech Input Device. The first working demonstration of SID used a slide projector which was controlled with one of six phrases such as "Switch On" or "Next Slide Please". For this demonstration however no computer was used, all the recognition being done by sequential logic. This machine was re-activated for the British Genius Exhibition in 1977 and was used by the general public for six months.

Although the design of SID has been changed considerably over the past few years, mainly because of the new technology available, the basic concepts have remained the same. It would take too long to explain the full workings of a SID but the fundamentals are of interest and we will try to give an understanding of these.

Hardware Vs Software

The system that has been devised at the NPL analyses the speech waveform and every 10 mS produces a digital byte that is fed to a computer. The data reduction process is performed in hardware to enable a high speed of recognition, the software merely collates the data and compares it with its "Library" of words or phrases to produce a match.

The human voice can be broken down into three main sections of interest, i) Voiced sounds, ii) Fricative sounds and iii) Silence. This is a simplified view but will suit our purposes.

Voiced sounds. These are produced by the excitation of the larynx and this causes certain cavities within the head to resonate, see Fig 1. A typical voiced waveform can be seen in Fig 1a. This can be broken down into three main parts, the larynx period, the first formant and the second formant. These formants are of different frequencies and are produced by the positioning of the tongue within the mouth. By moving the tongue around from one vowel sound to another a dipthong is produced, another fundamental voice characteristic. For example in the word "NINE" the dipthong is produced by moving from the vowel sound "AA" to the vowel sound "EE".

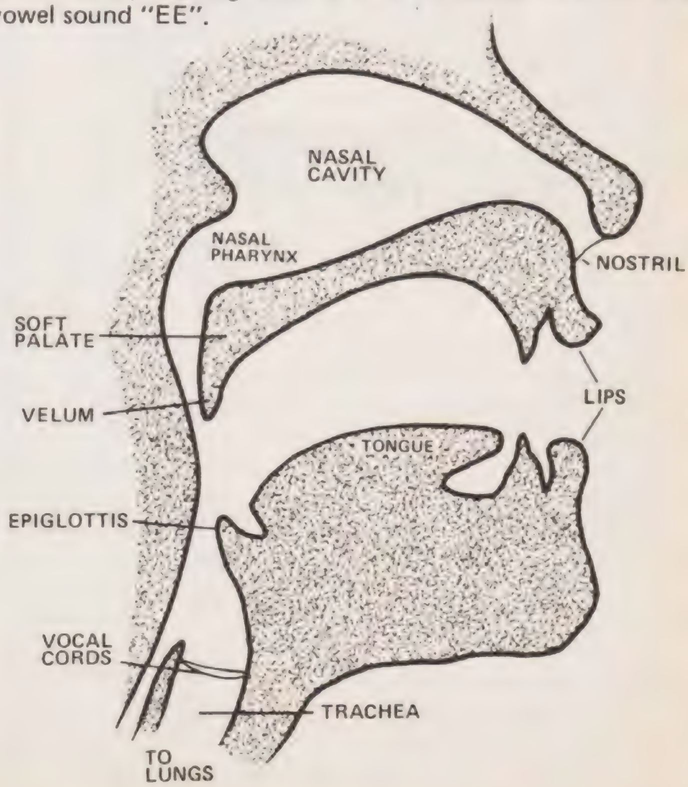


Fig.1 The human vocal tract.

Fricatives. A typical fricative waveform can be seen in Fig 1b of the "S" type sound that we find in "Sit" or "Six". Although the tongue and lips are positioned to form cavities within the mouth the larynx is not excited and so there is no repetative structure to the waveform.

Silence. When gaps of silence occur within a word they carry information to the listener. However in continuous speech there are seldom gaps of silence between words. On the early versions of SID silence was defined as being neither voiced or fricative. Nowadays, however, silence is determined as the continuous background level and this allows the system to operate in such noisy conditions as are found on telephone lines.

The Process Of Processing

On the early SID's no account was taken of bandwidth restrictions (eg: telephone lines) and a high quality dynamic mic was used on the system. An AGC was also used to compensate for any small amplitude variation which occurred between speakers. The first processing that is done on the speech is to discriminate which quality is present. This is done by the VFQ card which measures the relative power (energy) present in two band pass filters, see Fig 2. A certain amount of hysteresis is built in to allow the detection of silence if neither filter contains sufficient energy.

If a voiced sound is detected two more band pass filters are enabled, corresponding to the frequency bands of the first and second formants. Having filtered the speech into these two bands the result is clipped to produce a digital signal and this is fed into a delay line. Tappings are taken off the delay line and a wave form produced by correlation. This waveform consists of a frequency dependant voltage and is used to switch an op-amp into saturation at a given frequency — SID uses seven of these barriers for each of the two bands, the low range vary from 200 to 800 Hz and the high range vary from 800 to 3 kHz. The outputs of all these barriers are cleaned up to remove pulses of less than 15 mS in duration and "lock-up" logic is used to ensure that when one barrier is asserted all those lower in frequency are also asserted. A block diagram of the system is shown in Fig 3.

We now have a total of 19 "bits" of information, that is three voice qualities and sixteen descriptions. These are reduced by a logic board to eight bits suitable for sending to the computer. A typical display is shown in Fig 4. This is for the word FISHES and has not yet been reduced for transmission.

Software Requirements

Before any attempt is made to match any input pattern with any stored patterns, ie: recognition, the data must be sorted out into the voiced qualities and their descriptions. Because the computer knows that it will receive a byte every 10 mS it can also measure the duration of each voice feature found. Two typical samples of this are shown in Fig 5. They are taken from different speakers and show the utterance "NINE". The letter of the left hand column indicates the

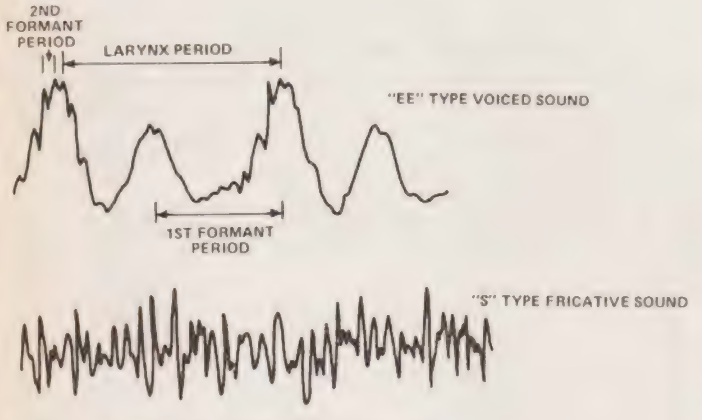


Fig.1a and b Typical speech waveforms, see text for details.

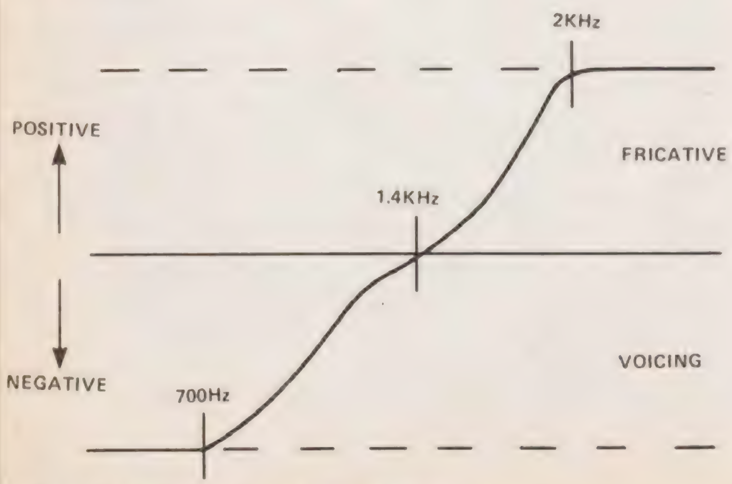


Fig.2 The characteristic of the VFQ detector. Hysteriesis is built in to detect silence if neither band is energised.

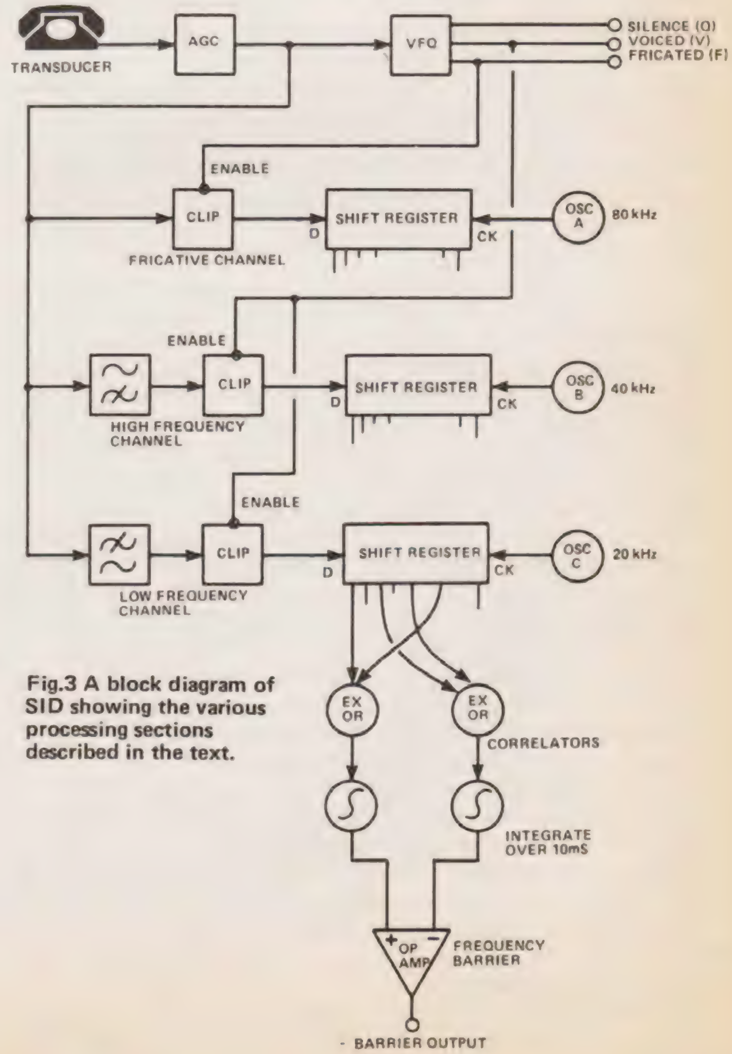


Fig.3 A block diagram of SID showing the various processing sections described in the text.

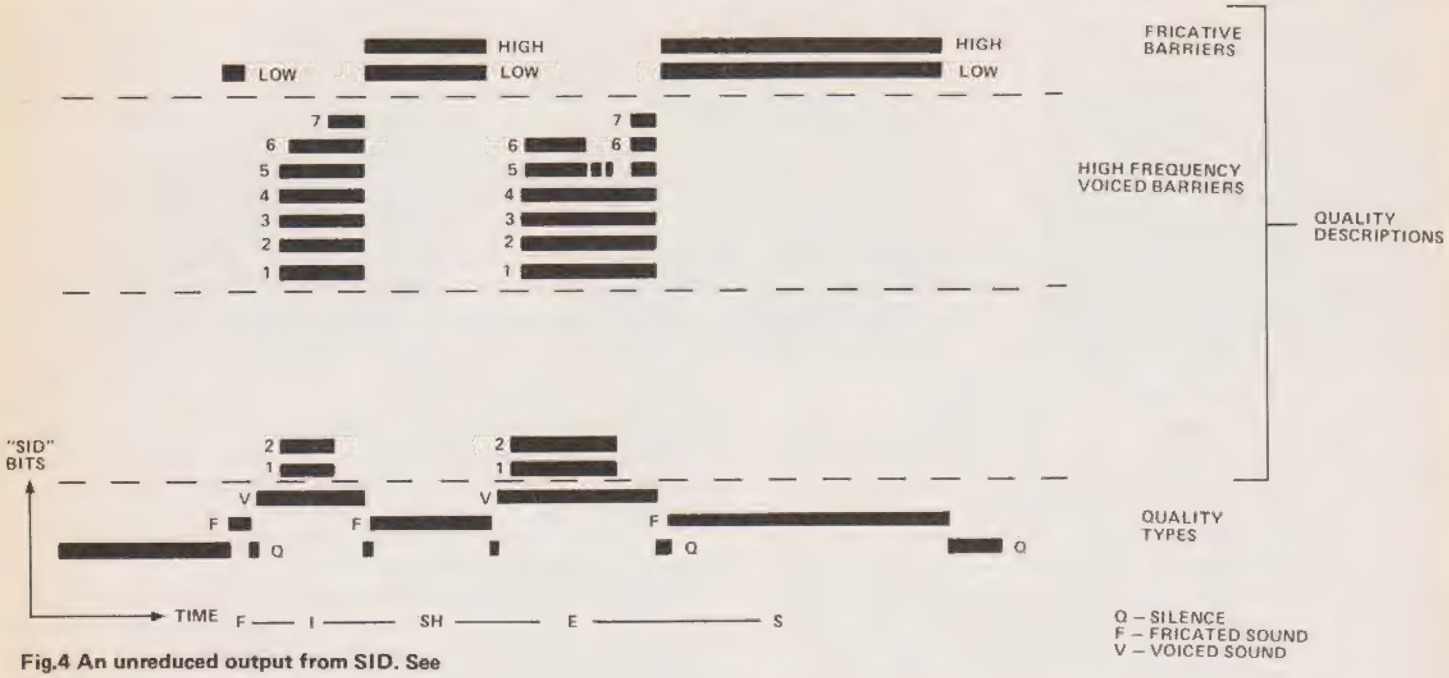


Fig.4 An unreduced output from SID. See text.

quality, the right hand column is the duration in 10's of mS and the centre data is the description of that quality. In the centre of the data we find V4 progressing through V5 and V6. This is a dipthong and is characteristic of the word "NINE". The same information is present in both utterances of the word, despite the fact that the speakers were different.

To complete the recognition the patterns now obtained are matched against a library set of patterns and the best fit is given the highest score, and thus the most probable "recognition". Because of several words are subsets of other words, six and sixteen for example, the utterance six will score a low probable match on sixteen, if sixteen is stored in the same library.

A Flying Start

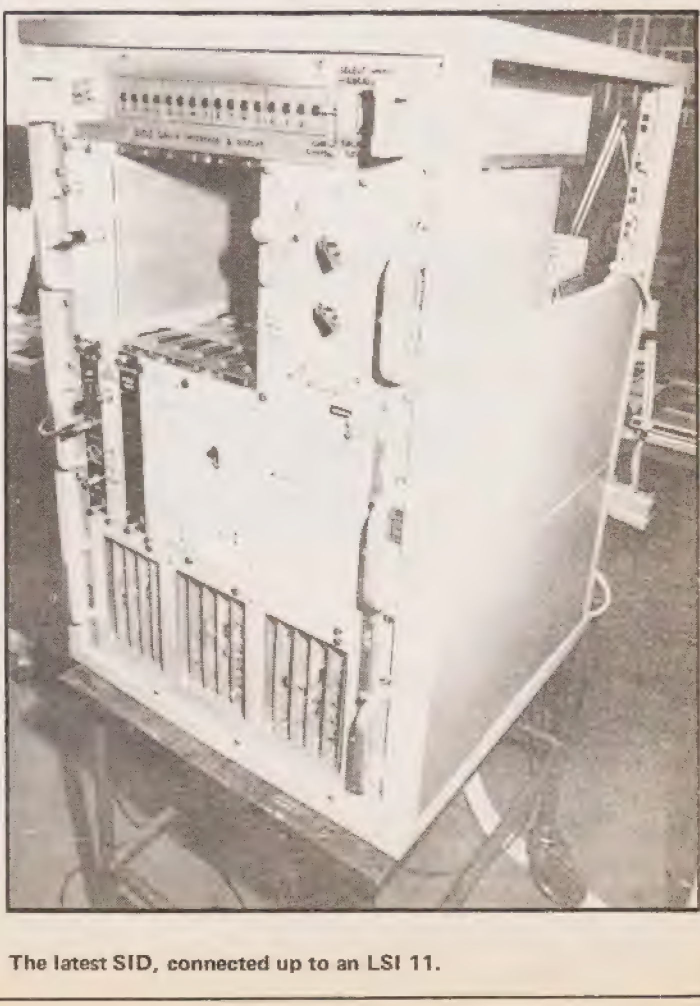
One of the most impressive demonstrations we saw at the NPL was the "Pilot Cockpit". A suite of programs is run to simulate a cockpit on an aeroplane where the pilot can update various pieces of information. Once the program is running it is listening all the time to the speech input but looking for one specific word, this key word being "START". Under normal conversation conditions nothing happens but when the word is uttered in isolation the machine instantly goes into operation and displays the set of available commands on the VDU. The pilot now has the choice of inspecting and altering one of four items, height, bearing, speed and position. Once again a conversation may be carried on with no result until one of the four keywords is uttered. Up to this point the machine has been taking account of words in isolation but once in the update mode it will accept a numeral string, that is as continuous speech.

The whole system is designed to allow the operator to converse as naturally as possible with the computer, he is not forced to constrain himself to single words or to turn the system on or off when he wants to use it.

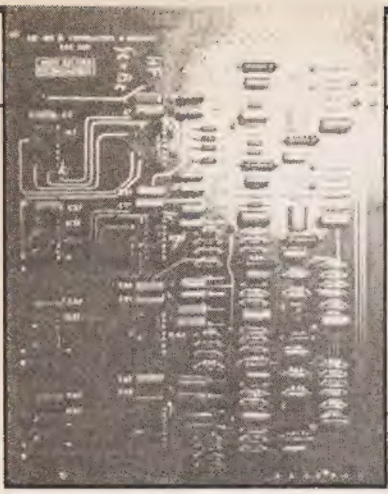
At any point in the sequence the machine is only looking for a specific set of words to be spoken, this reduces the storage necessary to an amazing 4K, program and all. The machine will even allow a certain of umming and erring to occur at the command level. The ability to detect key words embedded in other speech and continuous speech is unique to the NPL's equipment and software techniques.

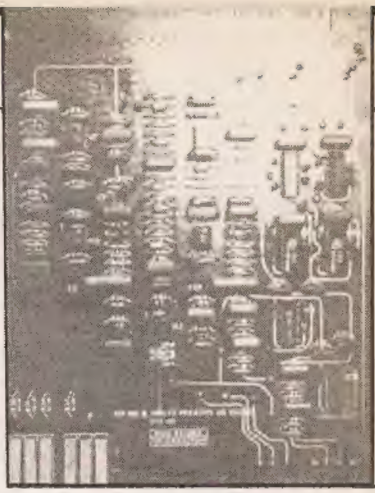
The Real World

Quite apart from being used in laboratory environment the NPL equipment has been used in anger at a hospital as part



The latest SID, connected up to an LSI 11.





```
Q======================Q      0
Q                      Q 8    1
V     1                       2
V      2   67                 3
V      2   6                  1
V      2  56 8                1
V        45  8                1
V        4   8                1
V        4                   21
V        45                   3
V         5                    1
V         5  8                3
V         56 8                4
V      2                      1
V     12                      4
V      2   67                 5
V      2 4   8                1
V        4   8                1
V      2     8                1
V      2   67                 1
V     12                      1
V        4                    1
Q======================Q      0
V     1                       3
V           7                 3
V      2   67                 1
V      2 4   8                1
V        4   8                2
V       34                   12
V        4                    4
V        4   8                1
V        45  8                1
V      2  56 8                1
V      2   6 8                2
V          6                  6
V      2   6                  1
V      2   67                 1
V      2   6                  1
V          6                  2
V      2   6                  1
V     12                      2
V      2                      1
V      2  56 8                1
Q======================Q      0
```

Fig.5 Two utterances of the word nine after data collation by the computer.

of a medical interviewing system. The machine was designed to recognise the words "Yes", "No" and "Don't know" and all recognition was performed in hardware. The resulting decision was fed, via the telephone networks, to a remote computer which ran the interview program. Despite the use of patients suffering from severe bronchial complaints a recognition rate of 63% was achieved.

The real purpose of the experiment however was *not* to recognise the spoken utterances of the patients but to see if speech recognition was an acceptable alternative to the use of a keyboard terminal that had previously been supplied. The general feeling of the patients was that they found the speech system extremely "useable" and preferable in many ways to the previous system.

Another application of speech recognition that is currently being undertaken is the cockpit situation. Marconi Avionics are developing the NPL system with a specialised vocabulary for use in the cockpits of military aircraft.

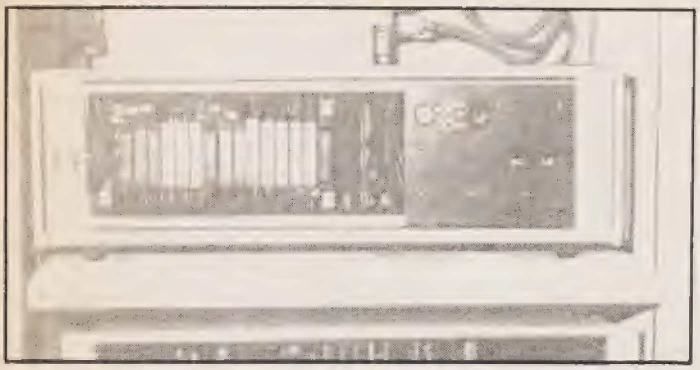
An Alternative

One commercially available system has been marketed in the UK by EMI. Developed by Threshold Technology in the States it is similar to the NPL system in that dedicated hardware processing is used before the data is fed into the computer. However, the system does require words to be spoken in total isolation and also has to be trained by each individual speaker. You can, if you want to, go out and buy one today for about £6000. This system is being used by, among others, an Australian slaughterhouse and the German Post Office. About 300 Threshold systems are in use, worldwide.

The obvious advantage that any direct voice input system has over a keyboard is that an operator can use his hands to do the job and report on the progress with his voice. In the slaughterhouse situation the meat inspector can describe the status of the carcase with one word from a choice of perhaps ten and the computer can then "tag" the appropriate carcase with that description and pay the owner as well as arranging for suitable disposal of the meat at the same time.

Similar But Not So Similar

Both recognition systems that we have described use hardware pre-processing and feed the collected information to a computer for further analysis. Whilst the NPL system is a multi-speaker system it will always produce it's best results on individuals that have pre-trained it. The Threshold system however relies totally on being pre-trained by each operator that uses it. The NPL machine will recognise words in it's



From left to right:— Three typical processor cards from SID, correlators and barriers, filters and clippers and the VFQ discriminator The right hand photo is of the original SID which was built in 1972.

vocabulary in both isolation and when spoken as part of a sentence or phrase, Threshold relies on isolated utterances for successful operation. It is recognised by both development teams that speech recognition systems will never totally replace key input systems and such wonderful machines as speech input typewriters are many years away. However it has to be accepted that both research teams have produced a device which will recognise human speech. This in itself is a great achievement, it has taken tens of thousands of years to develop speech as a communication medium but only twelve to connect it to a computer.

What The Future Holds

The main task for the next generation of SID's is to undertake the analysis of speech under conditions of both noise and restricted bandwidth. Once success has been achieved in these areas use of remote recognition devices over a public telephone network becomes a reality. After all, we humans can recognise speech under the awful telephone conditions so the development of a machine to do the same should not be too far away. The latest version of NPL's SID is indeed capable of operation on the telephone bandwidth and this is the system that is being exploited by Marconi Avionics for their pilot cockpit system.

There are more speech features to be analysed, plosives, stops and nasals for example. Any recognition system will be able to work better if it has more relevant information, redundancy is very important in speech. Software is currently under development to generate vocabularies directly from speech input to allow even more training of the machine than is currently possible. The NPL system is also being switched from a PDP 8f mini computer to an LS1 11 microprocessor, giving an increase in computing power and reduction in physical size at the same time. The immediate aim of both speech recognition development teams is to gain a foothold in the defence market. This highly specialised area requires techniques to get over such problems as stress under battle conditions and high ambient noise as well as rugged electronic design needs. To quote Brian Pay, "When you've solved the defence problem, you've solved the lot."

The Final Word

Any speech recognition system produced under todays technology will never achieve the dizzy heights of HAL. However there are systems being used now that at least have one or both feet on the ladder. Language is no problem, you just change the vocabularies, and it is conceivable that within this authors working life systems will be available so that you can interact with computers from your armchair, through the telephone system.

With information systems being one of todays big developments speech recognition could well be tomorrows means of controlling them.

The working environment. SID is the lower unit on the left.

Mr. P.J. Marshall

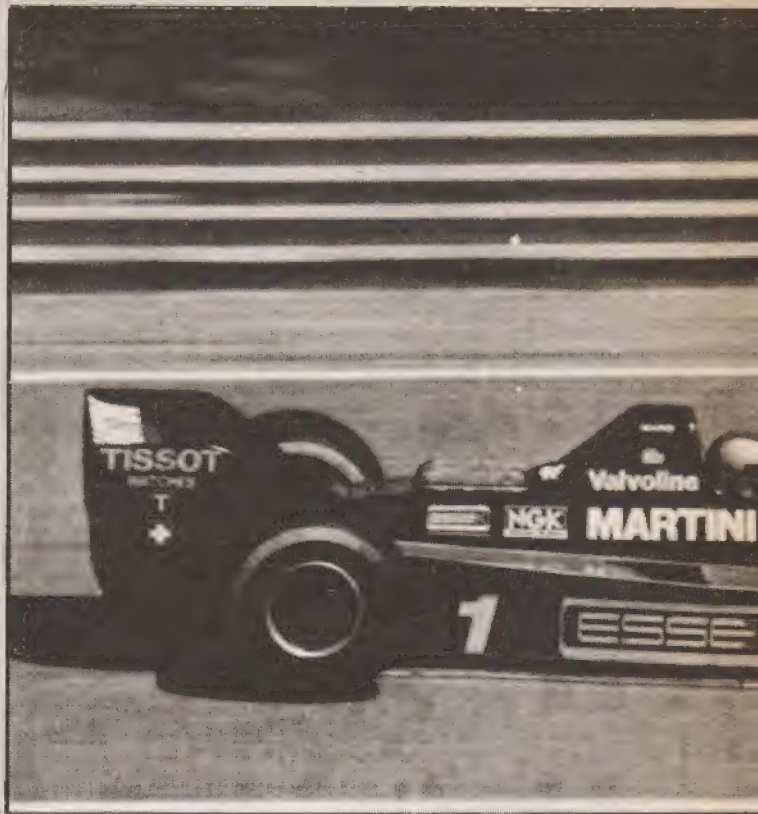
BRANDS

Driven to despair with TV? Try our 'Brands' game for some high speed fun

This Softspot program has been written in a "Standard BASIC" and should be easily adaptable to run on any machine. No graphics are used in the program, thus making it simpler and faster to run. It should prove easy to modify the basic program to include graphics for PET owners amongst others. The conversational method of programming used requires little explanation and there are some interesting subroutines which can be adapted for other gaming programs.

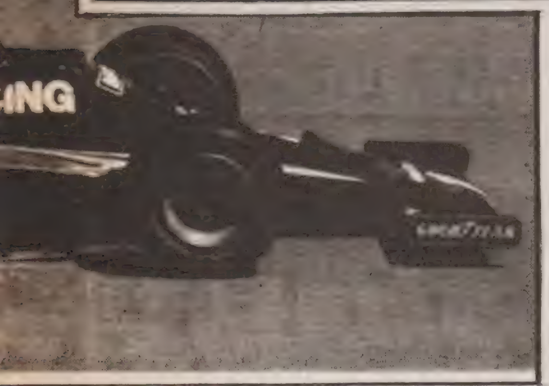
Fig 1. The program listing for Brands.

```
0005 DIM A$(15)
0010 A$(1)="STRAIGHT SECTION"
0020 A$(2)="MED BEND COMING"
0030 A$(3)="MED RIGHT HANDER"
0040 A$(4)="STRAIGHT"
0050 A$(5)="HAIRPIN COMING UP"
0055 A$(6)="HAIRPIN!!"
0060 A$(7)="STRAIGHTENING"
0070 A$(8)="MED LEFT HANDER"
0080 A$(9)="STRAIGHT"
0090 A$(10)="SHARP RIGHT"
0100 A$(11)="STRAIGHT"
0110 A$(12)="FAST RIGHT NEAR"
0130 A$(13)="FAST RIGHT BEND"
0140 A$(14)="PITS STRAIGHT"
0150 DIM R(5)
0160 DIM S(15)
0170 DATA 196,143,96,78,67
0180 DATA 160,110,51,110,84,42,75,
     120,150,60,120,98,82,160,160
0200 FOR I=1 TO 5
0210 READ R(I)
0229 NEXT I
0230 FOR I=1 TO 15
0240 READ S(I)
0250 NEXT I
0260 Z=0
0261 K=0
0263 I=0
0264 DIGITS= 2
0265 Q5=0
0266 V=20
0267 G=1
0300 PRINT CHR$(26)
0310 PRINT "THIS IS A MOTOR RACING
     GAME WHERE YOU HAVE TO DRIVE
     A FORMULA"
0320 PRINT "ONE RACING CAR FOR TWO
     LAPS ROUND THE SHORT COURSE
     AT BRANDS"
0330 PRINT "HATCH AT EACH STAGE OF
     THE CIRCUIT YOU WILL BE TOLD
     WHAT"
0340 PRINT "THE ROAD IS LIKE AHEAD,
     AND WHAT THE MAXIMUM SPEED
     IS FOR"
0350 PRINT "THAT SECTION"
0360 PRINT
0370 PRINT "ALL YOU HAVE TO DO IS
     SPECIFY THREE THINGS...."
0380 PRINT
0390 PRINT "1)....GEARS ..1 TO 5"
0400 PRINT "2)....BRAKES..0 TO 9"
0410 PRINT "3)....THROTTLE.0 TO 9"
```




```
0420 PRINT
0430 PRINT "THE REV LIMIT ON YOUR
     ENGINE IS 10000 R.P.M. YOU MAY
     EXCEED"
0440 PRINT "THIS FIGURE ONLY SIX
     TIMES, THEN YOUR ENGINE BLOWS
     UP"
0450 PRINT "THE SAME THING HAPPENS
     THE FIRST TIME YOU EXCEED
     10000 RPM"
0460 PRINT
0462 PRINT
0463 PRINT "ROLLING START AT 20
     M.P.H."
0464 PRINT
0470 PRINT
0480 PRINT "THE FLAG IS UP......."
0490 PRINT ".....DOWN  ......
     OFF YOU GO !!"
0500 B6=0
0501 PRINT
0510 FOR A1=1 TO2
0520 PRINT
0530 IF A1=2 PRINT "YOU ARE NOW
     STARTING LAP TWO"
0540 FOR I=1 TO 14
0550 PRINT
0560 PRINT "SECTION ",I
0570 T5=RND(0)
0575 M=S(I)*(I+T5/10)
0580 PRINT A$(1)
```

A typical screen display from the game.



```
0590 PRINT
0600 PRINT "MAXIMUM SPEED ON THIS
     SECTION ",M,"M.P.H."
0610 IF T5>.87 THEN 640
0620 PRINT "DRY ROAD .. GET YOUR
     CLOG DOWN !!"
0630 GOTO 670
0640 PRINT "........***********
     RAIN ::::::::........"
0650 PRINT " WATCH YOUR STEP ..
     SLIPPERY ROAD AHEAD "
0660 PRINT
0670 INPUT "GEARS.....",G
0675 IF G>5 THEN 670
0680 INPUT "BRAKES....",B
0690 IF B>9 THEN 680
0695 B6=B6+B
0700 B1=B-(B*B6/200)
0710 INPUT "THROTTLE...",T
0720 IF T>9 THEN 710
0721 R=V*R(G)
0722 IF R>9000 THEN 725
0723 P=R/6000
0724 GOTO 730
0725 P=1.5-(R-9000)/10000
0730 V2=V+(T-1)*(10-G)
     *P/1.65-B1*7.25
0740 IF B>8 THEN IF T5 .87
     THEN 1500
0750 IF V2-5>M THEN 1250
0760 IF V2>M THEN PRINT"WATCH YOUR
     SPEED FANGIO !!"
0770 K=(V+V2)/2
0780 Q=3600/(20*K)
0790 Q5=Q5+Q
0800 R=V2*R(G)
0810 V=V2
0820 PRINT
0830 PRINT "GEAR      SPEED
        REVS       TIME"
0840 PRINT G,TAB(11),V,TAB(22),
     R,TAB(34),Q5
0850 IF R>10000 THEN 900
0860 NEXT I
0870 NEXT A1
0880 GOTO 2000
0900 Z=Z+1
0905 IF R>12000 THEN 1000
0906 PRINT "WATCH YOUR REVS !!"
0907 PRINT
0910 IF Z=2 PRINT "THATS THE
     SECOND TIME"
0920 IF Z=3 PRINT "THATS THE
     THIRD TIME..."
0940 IF Z=4 PRINT"THAT'S THE
     FOURTH TIME...."
0950 IF Z=5 PRINT"THAT'S THE FIFTH
     AND LAST TIME...."
0960 GOTO 860
1000 PRINT "YOU'VE BLOWN UP YOUR
     ENGINE!!!!TOUGH LUCK"
1010 GOTO 2030
1250 IF V2>M+12 THEN 1300
1260 PRINT "YOU HAVE SKIDDED AND
     LOST SPEED"
1270 V2=V2-1.2*(V2-M)
1280 GOTO 770
1300 PRINT "YOU HAVE CRASHED
     AT  ",V2+2.2," M.P.H."
1310 IF V2-M>16 THEN 1350
1320 PRINT "CAR DAMAGED...YOU'RE OK"
1330 GOTO 2030
1350 PRINT "SORRY IT WAS FATAL...."
1360 GOTO 2030
1500 PRINT "YOU SLAMMED ON THE
     BRAKES IN THE WET AND
     SPUN OFF !!"
1505 GOTO 1350
2000 PRINT
2010 PRINT "YOU COMPLETED THE COURSE
     IN ",Q5,"SECONDS...WELL DONE!"
2020 PRINT "YOU'RE AVERAGE SPEED
     WAS ",84*60/Q5," M.P.H."
2030 PRINT
2040 INPUT "ANOTHER GO
     (1=YES 2=NO) ",J
2045 RESTORE
2050 IF J=1 THEN 170
```

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AD INDEX

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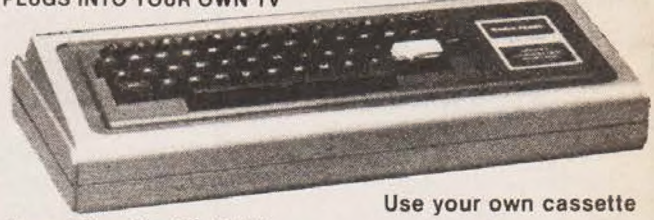

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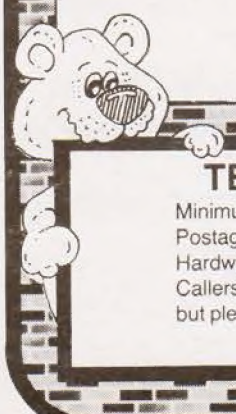

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